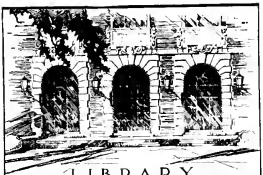

A HISTORY OF
THE COLLEGE OF ENGINEERING
OF THE
UNIVERSITY OF ILLINOIS
1868-1945

Part I

BY

IRA O. BAKER, C.E.'74
Late Professor of Civil Engineering, *Emeritus*

AND

EVERETT E. KING
Professor of Railway Civil Engineering, *Emeritus*

URBANA, ILLINOIS

CONTENTS

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

TABLES

FOREWORD

This publication, "A History of the College of Engineering of the University of Illinois, 1868-1945", is an attempt to bring up to date a work that was begun by Professor Ira O. Baker many years ago and which was partly put into manuscript form by him in 1920. Its purpose is to serve as a record or as a reference book for the members of our own staff and such others connected with the University as have an interest in the College, its organization and its policies, its objectives and its achievements.

The files of many of the University offices have been made available for use in the preparation of the text, and, in addition, much material has been drawn from the records of the Bureau of Institutional Research and the University Historian, from the annual reports of the Heads of the Departments in the College of Engineering and the Dean of the Graduate School, and from the semester reports of the Associate Dean of the College. Much material has been taken, also, from such publications as the Annual Register, the reports of the University Trustees and the University Comptroller, from The Illinois Technograph, from the regular and special periodicals published by the office of the Alumni Association, from publications issued by the Engineering Experiment Station, and from special bulletins and other articles sent out by the College office and by the several College departments. I have drawn very heavily, furthermore, on President James' "Sixteen Years at the University of Illinois".

The members of the departmental staffs have been very generous in their assistance in providing materials and in reading the text. Miss Huber has read portions of the manuscript and has offered many suggestions that have led to its improvement. Her staff has assisted very materially by mimeographing the notes. Mr. C. W. Paape also read portions of the text and offered many valuable suggestions for its improvement.

E. E. King

June, 1947

CHAPTER I

THE BEGINNINGS OF THE UNIVERSITY OF ILLINOIS

The Morrill Land-Grant College Act - At an early date in the history of Illinois, the citizens of this State became extraordinarily active in securing federal aid for the support of higher education. Among other things, the General Assembly memorialized the Congress of the Nation, praying the Federal Government "To appropriate to each State in the Union, an amount of public land, not less in value than five-hundred thousand dollars, for the liberal endowment of a system of Industrial Universities, one in each State in the Union, for the more liberal and practical education of our industrial classes, in their various pursuits, for the production of knowledge and literature needful in those pursuits, and developing, to the fullest and most perfect extent, the resources of our soil and our arts, the virtue and intelligence of our people, and the true glory of our common country."[1]

Particular emphasis was laid on industrial education, and much personal as well as collective work was done in the effort to secure federal subsidies in support of this particular type of instructional training. In the light of historical events, it seems perfectly safe to say that to the people of the State of Illinois more than to those of any other state, was due the passage of a bill by Congress, approved by President Lincoln on July 2, 1862, known as the Morrill Land-Grant Act, - a bill that provided for a more technical form of education than had been possible under previous conditions and one that was destined to have a far-reaching influence on American educational policies and institutions. Under the terms of this Act, public land scrip equal to 30,000 acres for each senator and representative in Congress "for the endowment, support, and maintenance of at least one college whose leading object shall be, without excluding other scientific and classical studies, and including military tadtics, to teach such branches of learning as are related to agriculture and the mechanic arts -- in order to promote the

---

1. "Makers of the University" by Henry M. Beardsley, '79, in Alumni Quarterly, 1910, page 2.

liberal and classical education of the industrial classes in the several pursuits and professions of life".

This grant thus became the foundation for a new type of industrial education to be supported jointly by federal and state or territorial governments. The terms of this act, however, had to be accepted and applied by the states and territories to their specific objectives before July, 1867, to become effective, -a proposition that served as a means for stimulating generally the organization of land-grant schools in the United States, for many of the present outstanding state educational institutions were established within a few years after that legislation was enacted.

The observations of President Edmund J. James regarding this matter were especially appropriate when he stated:

"The like of this act on the educational foundation has never been seen in the history of the world before. When you consider that a large proportion of these funds has been devoted to developing education in agriculture and mechanic arts pure and simple, you will realize how great an addition was made to the sum total of educational facilities by this Act of 1862.

"The Bill bears the name of Justin S. Morrill, who was senator from Vermont..... ....

"But great as is the honor due to Mr. Morrill, the real credit for originating the plan incorporated in the Land-Grant Act, belongs to an Illinois farmer and professor, Johnathan B. Turner. [1]

"Men had talked about the desirability of practical education for the farmer and the business man. Efforts had been made to get individual states to make appropriations for this purpose. Efforts had been made to get the Federal Congress to make institutions which should serve these ends. They had all failed. Efforts had been made to get the Federal Congress to appropriate public lands lying within the various states, to those states for the purpose of advancing the cause. This had been done in some instances, but it had not accomplished the results at all commensurate with ideas underlying this movement. It was Johnathan B. Turner who first proposed that the Federal Government should make a grant of public lands in support of practical education in higher institutions of learning to each state in the Union." [2]

1 Johnathan B. Turner served from 1833 to 1848 as a professor in Illinois College at Jacksonville. "From 1850 to 1867 he vigorously advocated 'A Plan for a State University for the Industrial Classes', and as the bronze tablet in the 'Old' Agriculture Building states: 'To his persistent efforts as a courageous advocate of scientific education, the nation owes the legislation which laid the foundation of this University and of all our land-grant colleges' ".-From "U. of I. Seventy-fifth Anniversary, 1868-1943, Convocation, March 2, 1943".

2 Commencement Address on June 12, 1912, as recorded in the Alumni Quarterly, 1912, page 185.

On another occasion, President James speaking again of the Land-Grant Act said:

"I do not know of any better illustration of the beneficent influence of subsidizing education by the largest potential unit, viz., the nation, than was afforded by the history of this Land-Grant Act of 1862. I am quite confident myself that the State of Illinois would not have established an agricultural college or an engineering school or any of the other departments of a state university for a full generation to come, if it had not been that the Federal Government offered this magnificent estate of half a million acres of land to the State for the establishment of a college of agriculture and mechanic arts, on condition that the State would organize the institution." [1]

<u>The Founding of the University</u> - Pursuant to this action of the Federal Government under which Illinois would receive 480, 000 acres of land valued at $600,000, the General Assembly of the State of Illinois took, almost immediately, the requisite steps necessary to secure the advantages of this proposed contribution by passing the following bill, signed by the Governor on February 14, 1863:

AN ACT accepting the donation of public Lands from Congress, approved July 2, 1862.

Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly, That the act passed by the Congress of the United States, donating public lands to the several states and territories which may provide colleges for the benefit of agriculture and the mechanic arts, approved July 2, 1862, be and the provisions therein contained, accepted by this State.

Section 2. Be it further enacted, That the Secretary of the State inform the Secretary of the Interior, at Washington, that the State of Illinois through their Legislature, has accepted the donation in said act.

Approved February 14, 1863.

Thus, within a little over eight months after the passage of the Federal Land-Grant Act of 1862, under which most of the states later established agricultural and mechanical colleges, the State of Illinois accepted the benefits of that Act under the conditions imposed, and was one of the first of the Nation to consider the founding of an institution of higher learning under the terms prescribed. It took four years, however, to decide on the location of the state institution, during which time several counties of the State entered into competition to secure the location of the University by offering to donate specific sums of money, or their equivalent, for the use of the school.

There were several very determined efforts on the part of certain citizens of Chicago to have the mechanical division of the proposed institution located there.

1 Alumni Quarterly, October, 1914, page 247

The first one came in July, 1864, when Colonel Robert Eastman[1] of Chicago proposed to Governor Yates that one-half of the funds provided by the Land-Grant Act for the establishment of an educational institution in Illinois, should be used for the development of an agricultural college centrally located and the other half to found a mechanical college in Chicago. In response to this request, the Governor appointed a commission to consider the proposition. This commission issued a call for all communities interested in securing the location of the educational institution to make application for a portion of the funds allotted.

Again, early in January, 1865, the Chicago group brought before the Illinois General Assembly a petition asking for a division of the funds to establish a mechanical school in Chicago. Furthermore, Representative Cook of Cook County even presented in February, 1865, a bill locating the agricultural school in Champaign County, but establishing the technical college in Chicago. This bill was defeated when the Legislature adjourned without giving it consideration.

The final attempt of Chicago interests to secure the mechanical or polytechnic portion of the new institution came in 1867. In January of that year, Colonel Eastman introduced a bill into the Illinois Legislature requesting that a portion of the Land-Grant fund be set aside for the polytechnic division of the school to be located in Chicago. The bill was referred to the committee on State Institutions, but after due consideration was tabled indefinitely.

The Griggs bill, - "an Act in relation to the location of the Illinois Industrial University", as it was then called,- finally passed by the General Assembly on February 24, 1867, and signed by Governor Oglesby on February 28, following, established a single educational institution furnishing instruction in both agriculture and the mechanic arts, located in Urbana. This act, providing for the incorporation, organization, and maintenance of the University, gave authority to the Board of Trustees to proceed and to formulate plans for the development of the new University, provided certain conditions or stipulations could be met by Champaign County. These conditions were duly met, for in addition to

1 "The Early History of the College of Engineering of the University of Illinois", by Fred H. Turner, The Technograph, October, 1933, pages 7-8

the special endowment by Congressional grant of 480,000 acres of scrip land, there was a donation by Champaign County of $400,000 including $100,00 in County bonds, one thousand acres of land, and a splendid university building practically ready for use that had been constructed for seminary purposes, known as the Urbana and Champaign Institute. In addition, Mr. M. L. Dunlap delivered to the Board $2,000 worth of shade and ornamental trees and shrubbery according to his contract, and the Illinois Central Railroad pledged the sum of $50,000 in freight over its lines.[1]

The Governing Body, - The Board of Trustees. - The original state law creating the University in 1867, placed the institution under the supreme control of a Board of Trustees consisting of the Governor, the Superintendent of Public Instruction, and the President of the State Board of Agriculture, who were members *ex-officio*, and twenty-eight citizens to be appointed by the Governor, - five from each of the grand judicial districts of the State, and one from each of the thirteen congressional districts. On account of the size, the body was found to be unwieldly , and in 1873, the number of members was reduced to eleven,- the Governor and the President of the State Board of Agriculture, *ex-officio*, and nine others who were still appointed by the Governor, three from each of the grand judicial divisions of the State. In 1887, a law was passed making membership in the Board of Trustees elective at a general state election and restoring the Superintendent of Public Instruction as a member *ex-officio*. There were at that time, therefore, three *ex-officio* and nine elective members. In 1917, the General Assembly passed a law reorganizing the administration of the State government. Under this law, the office of the President of the State Board of Agriculture was abolished on January 1, 1919, and since that time the Board of Trustees has been composed of two *ex-officio* and nine elective members. The nine members are elected at large by the voters of the State at the time of the general elections, for a term of six years,-the terms of three expiring every second year.

---

1 First Annual Report of the Board of Trustees, 1868, page 8.

Duties of the Board of Trustees.- By law, the Board of Trustees is committed to select the chief executive officer of the University, to appoint and promote members of the faculty upon his recommendation, to provide as far as possible the revenues required to meet the financial needs of the institution, and to determine the conditions of their expenditure. It must sanction all general rules and regulations for the conduct of the University and all major educational policies formulated by the University faculty; but at no time does the Board itself operate as an executive body.

Stated more specifically as provided by the law enacted for the organization and maintenance of the Illinois Industrial University, "The trustees shall have power to provide the requisite buildings, apparatus, and conveniences; to fix the rates for tuition; to appoint such professors and instructors, and establish and provide for the management of such model farms, model art, and other departments and professorships, as may be required, in the most thorough manner, such branches of learning as are related to agriculture and the mechanic arts, and military tactics, without excluding other scientific and classical studies."

Since 1873, the President of the Board has been chosen by the members of that body from among its own group for a term of one year. The Board is further organized by the appointment of an executive committee and of several standing committees that give special consideration to matters of general University policy and to student, alumni, and other needs. The Board meets once a month and at such other times as are necessary for the transaction of business requiring special attention. Its proceedings are published in biennial reports addressed to the Governor and the General Assembly.

Educational Objectives and Policies of the Pioneer Board of Trustees.- Section 4 of the Land-Grant Act of Congress in 1862 provided that the leading objective of the University shall be "without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the State may respectively prescribe, in order to promote the liberal and

practical education of the industrial classes in their pursuits and professions of life".

The University Catalogue and Circular[1] of 1867 stated :"The hope of the Trustees and Faculty is that the Institution will produce scholars of sound learning, but also of practical sense and skill - men abreast with the times - men of Christian culture, trained to affairs, and able and willing to lend a helping hand in all great practical enterprises of this most practical age; fitted to be leaders, if need be, in those mighty industrial interests on which the social well-being and civilization of our country so much depend. It is also their aim and hope that the University shall contribute to the increase and diffusion of knowledge of real science, and especially of that science which bears upon and promotes the useful arts."

In accordance with the Federal Land-Grant and the State acts previously mentioned, "and under which the University is organized, it holds as its principal aim to offer freely the most thorough instruction which its means will provide, in all the branches of learning useful in the industrial arts, or necessary to 'the liberal and practical education of the industrial classes, in the several pursuits and professions of life'. It includes this all useful learning - scientific and classical - all that belongs to sound and thorough scholarship".[2]

The report of the Committee[3] appointed by the Board of Trustees to consider "Courses of Study and Faculty" for the Illinois Industrial University contained among others the following statements:[4]

1 Page 4
2 University Catalogue and Circular, 1875-76, page 23.
3 At its first meeting, which was held in Springfield on March 12, 1867, the Board of Trustees appointed John Milton Gregory as Regent,-Doctor Gregory accepting the appointment and entering upon the duties of his office on April 1 following, as described later. At that same meeting, the Board appointed a Committee consisting of the Regent-elect and four trustees, to formulate an outline of the general aims of the University, and a plan of "Courses of Study and Faculty" for the Illinois Industrial University. At its second meeting, which was held on May 7, 1867, in the Chapel of the Urbana and Champaign Institute,-the structure that was soon to be taken over for University purposes,-the Board adopted the masterly report of the Regent and his Committee. So much preliminary work was necessary to place the University in line with this report, however, that the formal opening of the institution was postponed until the following year.
4. First Annual Report of the Board of Trustees of the Illinois Industrial University pages 47-64

"A clearer insight into the real intention of the Congressional grant may be gained if we call to mind that the colleges, existing at the time of the passage of the act making this great grant, were adapted only to fit men for the so-called 'learned professions', and that the influence of these colleges tended to withdraw their students from the pursuits of industry. Congress therefore proposed to create a new class of colleges, which should train men for industrial pursuits, and help to turn some portion of the great currents of educated life into the channels of industry. They aimed to link learning more closely to labor, and to bring the light of science more fully to the aid of the productive arts. Any other interpretation of the design of Congress than this would involve an absurdity.

"The Industrial College was not an expression of Congressional condemnation of the ordinary college, or opposition to it. A grant of a township of land in each new State had already provided for State Universities of the common sort. And besides these, rich and powerful seats of learning were everywhere fitting men for the great public fields of Law, Medicine and Theology. Congress only sought to extend still wider the benefits of science and liberal culture. They wished to establish other seats of learning, equally great and equally powerful, which should send scholars of high scientific attainments and broad and liberal culture, to the farms and workshops of the country.

****

"The Committee profoundly appreciate and commend the far-reaching wisdom and beneficence of these aims of the congressional grant, and would seek to carry them out to the very letter. They have discussed thus fully the intent of the Congressional enactment, in order to brush aside the false impressions which may have gained currency, and to bring out into clearer relief this grand idea of the Industrial University, as it lies involved in both State and National statutes- a true University, organized in the interest of industrial, rather than of the professional pursuits, and differing from other Universities in that its departments are technological rather than professional- schools of Agriculture and Art, rather than schools of Medicine and Law. Its central educational courses, while equally broad and liberal are to be selected to fit men for the study and mastery of the great branches of industry, rather than to serve as introductions to the study of law, medicine, or theology.

"The broad idea of the Industrial University proceeds upon two fundamental assumptions: First, that the agricultural and mechanical arts are the peers of any others in their dignity, importance and scientific scope: and, Second, that the thorough mastery of these arts, and of the sciences applicable to them, requires an education different in kind, but as systematic and complete as that required for the comprehension of the learned professions. It thus avoids the folly of offering as leaders of progress in the splendid industries of the nineteenth century, men of meager attainments and stinted culture, and steers clear also of that other and absurder folly of supposing that mere common school boys, without any thorough discipline, can successfully master and apply the complicated sciences which enter into and explain the manifold processes of agriculture and mechanic art.

"Nor is it to be forgotten that man is something more than an artisan, and that manhood has duties and interests higher and grander than those of the workshop and the farm. Education must fit for society and citizenship, as well as for science and industry. The educated agriculturist and mechanic will not infrequently be called to serve in Senate Chambers and gubernatorial chairs, and will need an education broader and better than the simple knowledge of his art.

"The State has need everywhere, but especially in the center and at the head of the great industries, on which, as corner stones, rest down her material progress and power, of broad-breasted, wise-hearted, clear-thinking men of rich, deep culture, and sound education.

"And besides all this, it should be reflected that half of the public value of educated and scientific agriculturists and mechanicians will be lost, if they lack the literary culture which will enable them to communicate through the press, or by public speech, their knowledge and discoveries; or if they are wanting in that thorough discipline which will make them active and competent investigators and inventors, long after their school days are over.

"* * * * * * * * Let the State open wide, then this Pierian fountain of learning. Let her bid freely all her sons to the full and unfailing flow: those whose thirst or whose needs are little, to what they require; those whose thirst and whose capacities are large, to drink their fill. Let the University be made worthy of the great State whose name it bears; worthy of the grand and splendid industries it seeks to promote; and worthy of the great century in which we live".

* * * * * * * * * * * * * * *

"The Industrial University such as we are planning is, in a large part, without precedent or example. The field of its labors is as yet untracked in its widest stretches. The very classes for whom its benefits are designed are as yet not half persuaded of the importance and real value of those benefits. The farmers and mechanics, accustomed to regard higher education as needful and desirable only for professional men, and almost wholly incredulous as to the utility of science in its applications to their work, will look with slow-coming faith upon a University which proposes to make farming scientific employment, and to lift the mechanics into a learned profession. They have, in many cases, yet to be convinced that a highly cultured mind may be linked to a brawny hand, and that a classical scholar may feel at home in a workshop; aye! and find use for all his scholarship and taste in the successful practice of his art.

"But the age is propitious. The working masses of mankind are waking to their needs, and calling for light. The thunder of the machinery by the side of which they toil, and the magic power of the new processes of arts which they daily employ, have roused the long slumbering power of thought. Brains are coming into use and honor in all the fields of human labor, and brains will speedily demand light and knowledge. In an age of learning, the farmer and the mechanic will soon come to covet the rich heritages of science for their sons. Already the children of the laboring classes are crowding the public high schools. They will not stop there. The University lies the next step beyond. They will crowd to its doors; and soon will begin to issue from its halls that long column, with its yearly additions, of graduates with broad brows, and science-lighted brains, bearing back to the farms and workshops an intelligent skill and power, to invoke new and unwonted fruitfulness from the soil and from the mechanic art".

These statements of the founders of the University point very definitely to the conclusion that these pioneers hoped to raise the status of the mechanic arts to the level of a learned profession and to provide systematic training in the field of applied science that would improve and increase the processes of production and evolve a great era of industrial enterprise. As we record the events of ensuing years, we realize it is little more than a truism to say that the plans

they laid for the development of a great educational plant were amply justified and the hopes they held have been signally realized no doubt, far beyond their fondest dreams.

<u>Proposed Departments and Courses of Study</u>- The report of the Regent and the four Trustees made in 1867 and discussed at some length in previous paragraphs contained the following outline of proposed departments and courses of study for the new institution:[1]

I Agricultural department

1. Agriculture
2. Horticulture
3. Landscape gardening

II Polytechnic department

1. Mechanical science and art
2. Civil engineering
3. Mining and metallurgy
4. Architecture and fine arts

III Military department

1. Engineering
2. Tactics

IV Chemistry and natural science

V Trade and commerce

VI General science and literature

1. Mathematics
2. Natural history, chemistry, etc.
3. English language and literature
4. Modern languages and literature
5. Ancient languages and literature
6. History and social science
7. Philosophy (intellectual and moral)

There was little encouragement to be found among educators of those times in support of efforts to build up a school teaching the fundamentals of the mechanic arts, for practically all of the institutions of higher learning were interested only in the simple, classical, or liberal arts courses; and the proponents of that type of school looked with great derision and scorn upon any attempts to formulate policies that had as their aim the teaching of the mechanic arts. Because of this state of affairs, there was little precedent to follow in modeling the polytechnic

1 Ibid., page 50

or engineering division of this new school, for engineering education being a comparatively new field, was offered in only a few institutions at that time. Rensselear Polytechnic Institute, Massachusetts Institute of Technology, and Cornell University had been started only two or three years previously. The University of Michigan had been giving some courses in engineering for several years, and a few other schools taught a few engineering subjects. In the main, however, there was little for a western school to follow; such an institution had to pioneer its own course of determination.

After this brief account of the various legislative acts creating the University, the resume of the aims of those who founded it and some mention of the general plan of administrative control, it seems appropriate to review the steps taken in opening the University, to present brief biographical sketches of each of its executive heads, known at first as regents, but later as presidents, and to record the outstanding events of their several administrations.

CHAPTER II

THE REGENTS AND THEIR ADMINISTRATIONS

General - From the time of the opening of the University until 1894, the chief executive officer of the University was called Regent, who was appointed by the Board of Trustees. Until 1873, he was made ex-officio a member of the Board of Trustees and presiding officer of both the Board and the faculty, but after 1873, the president of the Board was chosen by the Board itself from among those of its own group.

The regent was responsible for the preparation of the budgets and for the administration of the general policies defined by the Board of Trustees for the conduct of University affairs.

While it was in existence from 1867 to 1894, the office of regent was held by three persons: viz., by John Milton Gregory from 1867 to 1880; by Selim Hobart Peabody from 1880 to 1891; and by Johnathan Thomas Burrill (Acting Regent) from 1891 to 1894. Some discussion of their administrations follows in the next few pages.

A. John Milton Gregory, Regent 1867-1880

Background of Preparation and Experience - John Milton Gregory, the first Regent, was born on July 6, 1822, at Sand Lake, New York. During his student days he applied himself to law and theology and was later ordained in the Baptist Ministry. He served as State Superintendent of Public Instruction for Michigan from 1858 to 1863 and as President of Kalamazoo College from 1863 to 1867, receiving the honorary degree of LL. D. from the University of Michigan in 1866. He was elected Regent of the Illinois Industrial University at the first meeting of the Board of Trustees, March 12, 1867. He assumed the duties of his office on the first day of April following, as previously stated, and was officially installed at the formal opening of the University on March 11, 1868.

Opening of the University and the Installation of Regent Gregory - The University was opened for students on March 2, 1868, and was formally dedicated on March 11, 1868, as previously stated. The event was made the occasion for the for-

mal inauguration or installation of Doctor Gregory as Regent. At this function, Hon. S. W. Moulton presided over the ceremonies, which were held in the chapel of the new University Building in the presence of numerous visitors from all sections of the State. Music was provided under the direction of George F. Root, a well-known musician of Chicago, the dedication hymn having been written by Doctor Gregory himself. Letters were read from Governor Oglesby, Senator Yates, and General Logan. A portion of the message from Senator Yates, who was Governor of Illinois during the Civil War days, bore the following statements:

"My great hope is that this institution shall prove the crowning achievement of this age among all the grand works in behalf of popular education, which illustrates the splendid history of our state and that to the latest generation our young men shall have cause to bless the wise fore-thought of the men of this age, who have,, amidst gigantic war, not only vindicated the free institutions and ideas of self-government, but also founded this splendid nursery of free men and enlightened patriotism. An educated man may become unpatriotic, a patriot may become perverted through ignorance, but wisdom and patriotism hand in hand are invincible".[1]

The principal addresses of the occasion were given by the Honorable Newton Bateman, State Superintendent of Public Instruction, and by Doctor Gregory.[2] A few excerpts taken from the remarks of Regent Gregory are here repeated:

"Slowly a great want has struggled into definite shape in the hearts of mankind. The demand has arisen for deliverance from the evils of ignorance and for a more fit and practical education for the industrial classes. It is labor lifting its Ajax cry for light to guide its toil, and illuminate its life.

* * * * * * * * * * * * * * * * * * *

"To us it is committed, here in Illinois, to realize these hopes. Rarely has a grander duty, nor, perhaps a more difficult one, fallen to the lot of any body of men. We are the servitors of the age itself."[3]

The exercises were followed by a banquet in the dining hall of the University Building. Two days later, the first faculty meeting was held and the University

---

1 First Annual Report of the Board of Trustees, pages 151-2, and the Semi-centennial History of the University of Illinois by Burt E. Powell. Volume I, page XII

2 Historical Sketches and Annals, the Alumni Record, 1918, pages XI and XXXIII-XXXIV.

3 Makers of the University, John Milton Gregory, by Henry M. Beardsley '79, in Alumni Quarterly, 1910, page 5.

was considered a going institution.[1]

Doctor Gregory's Efforts in Orienting the University's Educational Trend - Such an institution as this was in large part without precedent or example, and the difficulties involved in the development of the infant institution were greatly increased, as was afterwards shown, by the resolute and far-sighted determination of Doctor Gregory and his colleagues in insisting, in the face of bitter opposition, on the most comprehensive and liberal interpretation of the Land-Grant Act and the State legislative enactment in establishing an institution of the broadest outlook, -one which should give instruction in the branches of learning relative to agriculture and the mechanic arts, but which should not exclude other scientific and classical studies.

Regent Gregory had an exceedingly difficult task in presenting and explaining to the people of the State the ideals and proposed policies of the new institution: first, because collegiate education for the industrial classes was largely an innovation and many wanted to limit materially the field of what has become the College of Liberal Arts and Sciences, while others were in opposition because the College of Agriculture did not run before it could walk; second, because of sharp differences of opinion in and outside of the Board of Trustees as to what should, and what should not be included in the work of the institution; for the numerous pamphlets, conventions, and other appeals by the people of Illinois to the University and the Legislature establishing the University, represented widely-different ideas and ideals in the State at large; third, because of intense antagonism developed in other parts of the State on account of the competition for the location of the institution; fourth, because there were almost no local organizations, such as the modern Chambers of Commerce, Rotary and Kiwanis Clubs, Women's Literary and Social

1 Writing her impressions of the old seminary building, which served as dormitory as well as recitation hall, Mrs. Frances Adelia Potter Reynolds, '74, and one of the first alumnae, said:"it was a large, plain, red brick, five-story building set down in the flat Illinois mud, with not a tree or a shrub, a spear of grass or a fence. It was as desolate a place as possible to imagine. But there were great changes in the next few months. Fences were built. Trees and shrubs were set out. Grass was sown, and refreshing green took the place of the mud. Gravel walks were laid out and made it possible to step without sinking shoe-deep in the mud". - Historical Sketches, Alumni Record, 1918, page XI.

Science Clubs, labor unions, etc., before whom he could appear to discuss the aims and methods of the proposed institution; and lastly, the people of that day were not receptive,- new ideals being viewed with scepticism.

These conditions demanded of the Regent of the embryonic state University no little tact and resourcefulness, and much heart-breaking labor. During the year between his election and the beginning of instruction, he utilized every opportunity to explain the principles of the new form of education and of the new institution, often speaking in churches at meetings called for that purpose, at teachers' institutes, and many times at county agricultural fairs talking from a farmer's lumber wagon to such audiences as he could draw from the side shows, the stock exhibits, and the horse races. As far as other duties would allow, he kept up this propaganda for several years after the institution opened its doors to students. He was a pleasing speaker, clear, forceful, eloquent; and he ably set the needs and ideals of the University before the people of the State; but the opposition he had to combat among groups in the different sections of the State, groups perhaps all equally in earnest to promote the most useful form of education, seriously retarded for a number of years the normal growth of the University.

Organization of the University into Schools and Colleges -The first mention of dividing the University into colleges was in the 1870-71 issue of the University Catalogue and Circular. The Catalogue and Circular of 1877-78 states the case a little more clearly, however, in the following presentation: "The Institution is a true University in the best American sense, though differing designedly in character of some of its Colleges from the older institutions of this country. It is divided into four Colleges, and these are again subdivided into Schools.. A School is understood to embrace the course of instruction needful for some one profession or vocation. Schools that are cognate in character and studies, are grouped under the same College".[1] The arrangement was as follows:

1 In 1945, the college is still the main administrative and educational unit, comprising departments or other primary divisions that are grouped around common interests. The School is an administrative and educational unit whose status is that between a college and a department.

I. THE COLLEGE OF AGRICULTURE

School of Agriculture | School of Horticulture

II. COLLEGE OF ENGINEERING

School of Mechanical Engineering | School of Civil Engineering
School of Mining Engineering | School of Architecture

III. COLLEGE OF NATURAL SCIENCE

School of Chemistry | School of Natural History
School of Domestic Science

IV. THE COLLEGE OF LITERATURE AND SCIENCE

School of English and Modern Languages | School of Ancient Languages

V. ADDITIONAL SCHOOLS

School of Military Science | School of Commerce
School of Art and Design

" Vocal and Instrumental Music, Telegraphing and Photography are also taught, but not as parts of the regular courses."

The chief advantage of the College as a unit in university organization is that such an arrangement provides for better coordination in the administration of the affairs of the several departments related by a common interest and for greater efficiency in the conduct of the instructional and research programs. This is not meant to imply, of course, that the colleges and schools are educationally separated here. They are interdependent, and cooperate fully in the conduct of the several instructional programs.

Requirements for admission in the Early Days of the University - At first, admission to the University was solely by prescribed examination, and the requirements in all colleges were very low. At that, scarcely more than half of the students could meet the conditions. In the first catalogue, the requirements for admission to the regular course in science, literature, and art was natural philosophy (physics), physiology, algebra, geometry, latin grammar, Caesar, Cicero, Virgil's Georgics, and Aeneid. In addition, it was recommended that each student should be at least eighteen years of age, although the minimum was fixed by law at fifteen. As listed in the 1868-69 issue of the University Circular and Catalogue, the requirements for admission were detailed as follows:

1. "Each student is required by law to be at least fifteen years of age, but it is believed that few will be found mature enough at this age to enter with the highest profit upon the studies of the University, and it is recommended as a general rule, that students should be at least eighteen years old before entering.

2. "The law also prescribes that 'no student shall be admitted to instruction in any of the departments of the University, who shall not previously undergo a satisfactory examination in each of the branches ordinarily taught in the common schools of the State'. In addition to these, candidates for any particular department will be examined in such studies as may be necessary to fit them to pursue successfully the course in that department.

"The chief aim of all examinations for admission to the University is to ascertain the student's preparation to pursue successfully the studies of the course. Hence, thoroughness, and a general knowledge of the subject, will be accounted as of more importance than the amount studied. A student of earnest purpose and a well-disciplined mind will often pursue a new study more successfully than one of much more extensive preparation, but of less discipline and diligence. Much more solicitude is felt about the progress of the student after he enters, than about the preparation made before he enters the University. Frequent and searching examinations will be held to test the progress in study, and to determine each student's fitness to remain in the classes. The University cannot be held responsible for the lack of thoroughness in the common-school studies, but will insist upon thoroughness in its own proper studies".

The Circular and Catalogue of 1869-70[1] stated:

"In addition, candidates for advanced standing must pass an examination in each of the branches already pursued by the class, or an equivalent therefore. Those desiring ancient languages must pass in the ordinary preparatory studies in such languages.

"There are certain elementary studies not yet reckoned among the 'branches ordinarily taught in the common schools', such as Elementary Algebra, Natural Philosophy and English Composition, which it is strongly recommended that students shall pursue before coming to the University. They necessarily precede the University courses. The advance of the class compels the discontinuance of instruction in these studies, and students should, if practicable, come prepared to pass examinations in them".

A typical set of examination questions listed on pages 30-33 of the 1869-70 issue of this Circular and Catalogue, included the subjects of Orthography, Reading, Grammar, Arithmetic, Geography, Algebra, Natural Philosophy, and Languages.

The first statement published concerning the conditions for admission to the College of Engineering was in the catalogue for 1871-72, in which the requirements for 1872 were the "four common-school studies" and also algebra to equations of the second degree, and plane geometry; and notice was given that the requirements for 1873 would include algebra through quadratics and natural philosophy (elementary physics), and for 1874, all of geometry and also botany and physiology. In 1876,

1 Page 23

the requirements were increased by adding bookkeeping and two terms of English. At that time the requirements for the classical course substituted a year each of Greek and Latin for the English and the sciences required for the other courses of the University.[1]

Provision for the Preparatory School and Academy - The entrance requirements of the University were gradually raised through the years and the best high schools of the State were able to keep abreast of these requirements. The system of accrediting high schools, begun about 1876, permitted students who were graduates of such schools to enter the University without examinations. However, there were many prospective students for whom no such accredited schools existed, and for these the Board of Trustees in March, 1876, made a special provision by establishing a preparatory department at the University, to be opened the following September, that several years later developed into the Academy. The Catalogue and Circular of 1875-76 carried this statement in this connection:

"The University has steadily refused till now to open any preparatory school. The preparatory work is well done in the many excellent High Schools of the State, and the funds of the University ought not to be diverted from their proper uses, to provide instruction in merely Preparatory Studies. A needful advance in the standards for admission to the College courses and the necessity of providing temporarily at least for those who will come from places where no good High Schools exist, now induce the Trustees to provide for preparatory classes in the studies lying between the common school studies and the College courses."[2]

Candidates in the preparatory class had to be fifteen years of age and had to be able to pass satisfactory examinations in arithmetic, geography, English grammar, and United States history.

Educational Policies of Doctor Gregory and his Administration - In his inaugural address on March 11, 1868, Doctor Gregory stated:

"It is no ordinary work which we are set out to do, and it comes to us under no ordinary conditions. We are not here to reproduce, in this new locality, some old and well-known style of college or university. Nor are we permitted to sit down in quiet to invent, at our leisure, some new scheme of education, which, when settled to our own tastes, we may offer for public patronage, as a manufacturer offers a new-fashioned piano or plough. No such easy task of leisure hours is allowed us.

---

1 The requirements for entrance to the College of Engineering were not changed from 1876 until 1892-93, except that from 1873-74 to 1890-91, a one-year Builder's Course was offered in the Department of Architecture for which the requirements for admission were only the four common-school branches.

2 Page 24.

Hosts of earnest men are impatiently waiting to see how we will meet the great duty which the country has entrusted to us."

The Catalogue and Circular of 1873,[1] contained the following statement further illustrating the early educational policies of the University:

"The University being designed not for children, but for young men and women who may claim to know something of their own wants, powers and tastes, entire freedom in choice of studies is allowed to each student, subject only to such necessary conditions as the progress of the classes, or the convenience in teaching requires. It is not thought useful or right to urge every student, without regard to his capacity, taste or practical wants, to take entire some lengthened curriculum, or course of studies. Liberty everywhere has its risks and responsibilities as well as its benefits, in schools as well as in society; but it is yet to be proved that compulsory scholarship is necessarily better, riper and more certain than that which is free and self-inspired. Each student is expected to weigh carefully his own powers and needs, to counsel freely with his teachers, to chose with serious and independent consideration, the branches he may need with earnestness and perseverance, without faltering or fickleness.

"It is necessarily required; 1st, That students shall be thoroughly prepared to enter and keep pace with the classes in studies chosen; and 2nd, That they shall take these studies when they are being taught.

"It is expected that each student shall have three distinct studies, affording three class exercises each day. But on special request to the Faculty, he may be allowed less or more, to meet the exigencies of his course.

"No changes in studies can be made after the beginning of a term, without permission of the Faculty.

"It is recognized that students will need advice in the selection of studies and in the arrangement of a proper course. To meet this need, the Faculty have carefully arranged several courses of studies which are expected to be followed by those who have no special reasons for divergence from them.

"Due care will be taken to prevent as far as possible all abuse of the liberty of choice. Students failing to pass satisfactory examinations in their chosen studies will not be allowed to remain and take other studies without a vote of the Faculty."

Experiments in the Use of Associate Examiners - In 1877 the Faculty adopted the plan of appointing another member of the staff to assist the regular instructor in the subject in conducting the final examination. The arguments for this procedure were that it would acquaint the various members of the faculty with the scope and methods of different subjects, and would also secure greater uniformity in the method of conducting the examinations and in grading students.

Under this plan most, if not all, of the examinations were oral. The examiners were reluctant to accept this method, since it would require many of them to

1 Page 21

participate in the examination of work with which they were not familiar; and the students were nervous for fear they would be examined upon phases of the subject not fully considered in the class. As far as the functions of the special examiner were concerned, they were in a large degree perfunctory. After a trial of three years, the plan was abandoned under the belief that nothing good had nor could come of it.

<u>University Finances</u> - The early years of the University's life were filled with perplexities due to financial stringency, which caused some clouds to gather on the administrative horizon. First, in March, 1870, the Regent reported to the Trustees that the expenses the preceding year had been $34,600, while the income was only $32,100, and recommended that the deficit be met by the sale of bonds received as a bonus for the location of the University, but urged that every effort be made to keep the expenses within the income.

Second, in 1871, the Legislature made an appropriation of $75,000 toward the erection of a building estimated to cost $150,000, with the understanding that at the 1872 session an equal amount would be appropriated to finish the structure; but in the meantime a gigantic conflagration had destroyed the business section of Chicago, and the Legislature decided to appropriate its available funds for relieving the situation there rather than for finishing the building here. Consequently, it really became necessary for the Board of Trustees to sell enough endowment bonds to complete the building. Earnest efforts were made later to persuade the Legislature to reimburse the endowment fund, but to no avail.

Third, the University had expanded more rapidly than its income warranted. The attendance of students increased rapidly, and the necessary expense for apparatus, library, and instruction increased still more rapidly; but there was no increase in the endowment nor in the income.

Fourth, the endowment, $314,000, was invested in Illinois county and city bonds most of which paid 8 or 10 per cent interest; but the makers of the bonds had the option of paying them or of reducing the rate of interest. The outcome was that within a few years all of the bonds were refunded at a lower rate. By this reductio

of the rate of interest, the income of the University between 1877 and 1883 shrunk one-half.

During the last four years of his administration, i.e., 1876-80, Regent Gregory in several of his reports to the Board of Trustees discussed the need of more funds, and suggested four ways of securing a greater income. These were, to raise tuition fees, to secure possession of certain college and seminary funds held in trust by the State of Illinois, to secure a fraction of a mill tax for the support of the University, and to obtain a legislative appropriation for current expenses. The Trustees seem to have given careful consideration to the need of funds, and concluded that the first three methods of increasing the income were unwise or impracticable; but seem not to have left on record any definite opinion about the fourth method.

In June, 1876, the Trustees gave notice that salaries would probably be reduced 10 per cent beginning September, 1877. In March, 1877, in referring to this matter, the Regent in his regular report to the Trustees said: "If the salaries can not safely be reduced to such extent as to bring them within the diminished income of the University, will it not be the duty of the Board to lay this fact before the Legislature of the state that the representatives of the people may have the opportunity to save the institution from harm, if in their wisdom it is necessary, as Michigan and Wisconsin have done in similar cases? Will the people hold us guiltless if we allow the fair name and the bright prospects of an institution which belongs to them and not to us, to be sullied or blighted without any appeal to their representatives for aid?" Evidently the Board thought salaries could be reduced safely, for they did reduce the larger ones by 10 percent. In addition, they also abolished some positions.

Apparently the Trustees lacked faith or courage to appeal to the Legislature for additional funds for current expenses. However, "in an immediate effort to increase receipts," they did authorize "the preparation and circulation, throughout every post office of the state, of circulars, posters, or such other advertisements of the institution as may be thought best fitted to call the attention of our people

to the University and its advantages." This method had little, or no effect, upon the finances; and at best could not have had, since the University was spending something like $150 per annum per student, while the student was paying only $15. Of course, a few more students would not have proportionally increased the total expense; but any considerable number would have increased the size of the larger classes so as to have required additional teachers, and hence would have added nearly proportional expense. In 1879, the Trustees recommended that an organized effort be made to secure a fraction of a mill tax for current expenses; but this result was not accomplished until 1911 -- thirty-two years afterwards.

A record of the total University income for the various bienniums is given in the following table:[1]

TABLE I -UNIVERSITY INCOME, 1867-1880

Year	Amount
1867-68	$72,754
1869-70	133,279
1871-72	173,102
1873-74	123,459
1875-76	183,870
1877-78	171,000
1879-80	133,089

These figures include amounts appropriated for new buildings mentioned in the next section.

New Buildings - Three major buildings were erected during Doctor Gregory's administration: Mechanical Building and Drill Hall in 1871, University Hall in 1873, and Chemistry (now Harker Hall) in 1878, all of which are described more fully in Chapter VI of this publication. All of the funds for the first and last of the three and about half for the second one came from legislative appropriations.

University Faculty - The Report of the Committee, consisting of the Regent and four Trustees, appointed to consider "Courses of Study and Faculty", contained the following statement regarding selection of the Faculty:

".........In the entire work of organizing the institution, there is no more difficult or important part than this. On the character and ability of its faculty, will the character and success of the University depend, more than upon

1 The Alumni Record, 1918, page XXXI

all other circumstances taken together. Buildings, cabinets, libraries, and rich endowments will be all in vain, if the living agents - the professors - be not men of ripe attainments, fine culture and eminent teaching powers.

".......Self-nominated candidates will always be abundant, but the men we want will need to be sought for as with lighted candles. The incumbent of a professor's chair should be no ordinary man. In this, its chief seat of learning, in which it proposes to provide for the highest education of its sons, and from which, as a great center of science, it seeks to diffuse light to all the great fields of its industries, the State needs men of the highest type, as scholars and as men. The qualifications of every candidate for a professorship must be rigidly scrutinized without fear or favor; and none but men of tried and proven ability must be admitted to a place. Older and ordinary colleges may do with second rate men; this University can only succeed with the best men.

"A good college professor should have the three-fold qualification of eminent and extensive scholarship, at least in his department; thoroughly-tested ability to teach; and high-toned, gentlemanly character and culture. The first two are indispensable qualifications; the third will never be overlooked by those who have marked how inevitably and ineffaceably the teacher impresses his manners and habits upon his pupils. If culture is the better part of education, high-toned character and genuine courtesy of manner and feeling are the better part of culture.

"......The corps of instruction may properly embrace four classes of teachers: 1st. Professors, or principal instructors in each department of study. 2nd. Assistant Professors - younger, or less accomplished teachers, employed in sub-departments, or to aid in departments in which the work can not be fully done by one man. 3rd. Lecturers, or non-resident Professors-men eminent in some specialty of art or science, who may be employed to visit the University at specified seasons, and give courses of lectures. 4th. Tutors, or young men, employed temporarily to give instruction in the more elementary studies."[1]

During the first term, which extended from March 2, 1868, to June 13, 1868,[2] and which had an enrollment of fifty men students,[3] the faculty consisted of the Regent, who was also Professor of Philosophy, and three additional members, two of whom started at the beginning and one began later in the term. At the time of the opening of the fall term of the next school year, however, five additional persons had joined the faculty, so that besides the Regent there was a Professor of English Language and Literature, who was also instructor in Natural Philosophy; a Professor of History and Social Science, who was also Instructor in Latin; a Professor of Natural History and Geology; a Professor of Agriculture, who was also Instructor in French; a Professor of Theoretical and Applied Chemistry; an Assistant Professor of Natural Science; and an Assistant Professor of Mathematics, who was also Instructor in Military Tactics.

1 First Annual Report of the Board of Trustees, 1868, page 61.
2 Report of the University of Illinois, 1868, pages 87 and 94.
3 Women were admitted in 1870.

The following table[1] gives the number of persons on the University faculty during the administration of Doctor Gregory:

TABLE II- NUMBER OF PERSONS ON THE UNIVERSITY FACULTY, 1867-1880

Year	Number of Members
1867-68	4
1868-69	11
1869-70	19
1870-71	20
1871-72	24
1872-73	25
1873-74	25
1874-75	30
1875-76	27
1876-77	25
1877-78	29
1878-79	33
1879-80	29

Events of Doctor Gregory's Later Life - Doctor Gregory continued to serve as Regent until September 1, 1880, when his resignation became effective. For a time after that, he was a member of the Commission of Education at Washington, D.C. during which period he held the title of Professor Emeritus of Political Economy at the University of Illinois. From 1895, to 1897, he was Acting President of Pennsylvania State College.

Doctor Gregory passed away in Washington, D. C., on October 19, 1898. His body was brought to the University of Illinois and placed in state in the rotunda of the Library Building (Altgeld Hall). On the following Monday, October 23, a memorial convocation was held in University Hall Chapel, following which his body was placed temporarily in a vault in Mt. Hope Cemetry. Within a short time thereafter, the Board of Trustees voted that the body of Doctor Gregory be buried in accordance with his wish, on the University Campus. This was during the following November. The site chosen was immediately west of University Hall, or as it now is, directly between the Administration and Mathematics Buildings, a site marked by a clump of low-growing evergreens surrounding a bronze tablet mounted on a boulder removed from the ground during the construction of Lincoln Hall.

President' Draper's Eulogy - The remarks of President Draper in opening the memorial convocation assembled to pay last tribute to Doctor Gregory seem very

1 "Sixteen Years at the University of Illinois", page 129.

appropriate to close the history of the first regency.

"John Milton Gregory came here in the spring of 1867 to make plans for this University, to lay the very bottom stones of its foundations, and, a year later, to stand in its doorway and receive its first students. How singularly qualified and adapted he was for such a work, for years has been upon the lips of many, but can never be told too often.

"He was then at the age of forty-five, He was a sound English and classical scholar. He had even more than the ordinary versatility of thorough scholarship, and he had already had much experience in educational administration. On occasions he wrote poetry of no mean order; silvery chimes rang melodies in the temple of his soul. Our art gallery will always bear witness that he had the eye and the feeling of an artist. He was a clergyman. Not only was his heart keyed to the music of the humanities and consecrated to the service of the Master, but his mind had been disciplined by the coldly intellectual and logical philosophy of Calvin. He had studied the Law. He knew the story of its development and venerated it for what it had cost. He had the battles of mankind for freedom and for progress engraved upon his heart, and was thoroughly familiar with the growth of institutions. He had many of the elements of a statesman. In a word, he knew history, and guided by its lights, could look clearly into the future. He was a forceful writer and an orator who could command a hearing. He had courage. He had Puritan blood in his veins, and it settled the way in which he would maintain a conviction. He could withstand an assault or he could lead an advance; he could rise to an occasion or he could wait with patience and bide his time. Perhaps more than all else he was a teacher. He had been an apt pupil, an ardent admirer and a strong friend of Eliphalet Nott of Union College, than whom no man in America had inspired and molded more lives. He acquired the spirit and ways of his own great college president. He could put his heart against the hearts of others and warm them, and he could link his mind into the minds of others to draw them out and invigorate them. Again and again former students have testified to me, and in telegram and letter are hourly testifying now, of the uplifting and lasting influence of Dr. Gregory upon their lives.

"These different qualities, blended together, mellowed and refined by experience, produced an altogether unusual man, one who could manage men and lead movements as well; one who could deal with the every-day questions of educational detail better than most men could do it, but who could not be content with doing that alone; one who could both fire souls and build institutions, and whose frail body was charged with a spirit which would permit him to do nothing less.

"Even more, and what is more important to us, there were not a half a dozen other men in the world thirty years ago who saw, as he did, the necessity of the next great step which was imperative to the complete and enduring development of popular education. His knowledge of history, his study of economics, his frequent contact with questions of state, and his love for the common brotherhood of man led him to see that the old system of education was not equal to the support of democratic institutions. This particular knowledge was the consuming fire in his soul. The enlargement of the educational plan so that it should carry the opportunity for a collegiate education to every home, and so that the influence of liberal learning should bear directly upon the vocations of the industrial masses, was the matter to which he was impelled by an irrestible impulse of his heart to give the great powers of his mind.

"This is the particular work he undertook for the people of the prairies and the new towns of this then pioneer commonwealth. His plans were adequate. He knew that in essentials they were imperative. He did not bow his head to the demand which the thoughtless multitude made for merely practical training, for he knew that what was demanded would be neither scientific nor practical, and that

it must be both if it would endure; he would have been false if he had wavered, and he could not be false. He would never lower the plan of education: he would uplift the common life. The crowd was disposed to ridicule his theories and overthrow his plans, but he would not allow it, and as he was right there was no need to allow it. In all this he but brought his personality to the surface of affairs. If he had permitted himself to be controlled by the crowd he would have disappeared in the crowd, and the University of Illinois would have been insufficient for its constituency and unworthy the great State for which it stands.

"His humanity, his learning and his courage laid the foundations not of a merely technical school, but of a University ready to supply instruction in any branch of advanced learning to anyone prepared to receive it. This distinguished him from among his fellows: it won him the enduring gratitude of Illinois and of the friends of progress throughout the world, in his own and in all generations. His students will cherish his memory for what he did to shape their lives, and well they may: but the University that is now, and the still greater University that is to be, will hold him in tender recollection for what he did for it. Indeed, his work is respected and his memory has become already a sacred influence in our life, but their value and their beauty will be more manifest to the University, the State and the Country, with each of the coming years which is yet unwound from the great reel of infinite time.

"We may take such formal steps as we can to honor his memory now; but what we do will seem feeble indeed; the University is his monument. He received from the State whose citizen and benefactor he became at middle life many marks of esteem; he was sent abroad upon important missions and called to high public service by the General Government more than once: but the honors which will be most substantial and last the longest will be the minds he quickened and the souls he inspired through personal contact, and yet more through the form which he was able to give and the spirit which he was able to breath into the University. These will be reproduced and multiplied infinitely".[1]

B. SELIM HOBART PEABODY, REGENT 1880-1891

Early Training and Experience - Selim Hobart Peabody was born in Rockingham, Vermont, on August 20, 1829, was graduated from the University of Vermont in 1852, and received his Ph. D. degree there in 1877. On March 11, 1868, University Inauguration Day in Urbana, he was selected as the first professor in the University and was offered the chair of Mechanical Science and Engineering; but after considering the matter for a year, declined. He did accept an invitation later, however, to join the University, for on October 10, 1878, more than ten years after his first appointment, he became Professor of Mechanical Engineering and Physics. Near the close of March, 1880, he resigned to accept an attractive position in New York City as editor-in-chief of what later became the International Encyclopedia. On July 27, of that same year he was called back to the University as Professor of Mechanical Engineering and Physics and as Regent pro tempore, for

1 "John Milton Gregory, LL. D., Memorial Convocation," pages 5-8.

Regent Gregory had announced his own resignation at the Commencement exercises on June 8, 1880. Dr. Peabody assumed his new duties on August 15, following, and on March 9, 1881, the next regular time for appointing regents according to statutory provision, he was formally made Regent. He was in the same year honored with the degree of LL.D. by the University of Iowa.

Doctor Peabody's Work as Teacher - For the first year after his election as Regent, Doctor Peabody taught all of the technical subjects in the mechanical-engineering course of study. He served as Professor of Mechanical Engineering and Physics until the fall of 1885, teaching resistance of materials and hydraulics to all senior engineers and physics to all juniors. In addition, he taught all seniors mental science, or psychology as it is now known, logic, and political economy,-subjects formerly taught by Regent Gregory. He continued to be Professor of Mechanical Engineering until the fall of 1887, after which time the title of regent stood as a position by itself.

Doctor Peabody's Work as Regent - In addition to the work of instructor, Doctor Peabody was untiring in his attention to his duties as Regent. Due to the conditions resulting from the lack of finances, he had almost no clerical help and practically no office equipment. As there was no registrar then, he with his own hands, made out all class cards at the beginning of each term and entered all grades at the close of the term. He conducted long-hand all the correspondence of the Regent's office, for he had no stenographer, and throughout his administration, the University did not own a single typewriting machine.

Notwithstanding the great amount of detailed labor required of him, he served the University with great fidelity and zeal. During the eleven years of his administration as Regent, mainly through his personal labors, the business and educational methods of the University were materially improved; and the system of accredited schools was extended and the relations of these institutions with the University were greatly strengthened. Some of the outstanding events of Regent Peabody's regime are described in the following sections.

Name of the Institution Changed from Illinois Industrial University to the University of Illinois- The chief argument leading to the establishment of land-grant colleges was the need of industrial classes for technical education, and in the early history of this institution all connected with it were proud of its title; but as time went on, penal or reformatory and manual-labor institutions, came to be called industrial schools, and the term industrial took on a meaning entirely different from what it had when the title of the institution was adopted. In 1878, Regent Peabody reported to the Trustees that the name of the University was "a misnomer which has already caused much confusion and the loss of many desirable students." As an example of the misapprehension caused by the name, a man wrote: "My wife has recently died leaving six children from 2 to 11 years old. On what terms will you take these children?" Misunderstanding the nature of the institution sometimes cast aspersion upon the students and graduates of the University. Students were sometimes asked: "What were you sent up for?" After the main difficulties were overcome--and there were many of them, for the proposal to make the change was contested bitterly even in the General Assembly and especially in the Senate--the name was changed by the Legislature, and the new name was approved by the Governor on July 19, 1885. This legislative act marked the culmination of years of patient effort on the part of Regent Peabody, in support of a movement started by the Alumni Association years before, and was considered one of the outstanding events of his administration.

The University Faculty - When Regent Peabody was appointed in 1880, there were in addition to himself, fourteen full professors, two assistant professors, one instructor, and four assistants on the faculty--twenty-one in all. During the year 1890-91, there were twenty-three full professors, two assistant professors, six instructors and assistants,--thirty-nine in all. This represents an increase of eighty-six per cent during his administration.[1]

In addition to this substantial growth in the number of the staff there was a distinct improvement in the quality of the work offered and in the standing which the institution had attained throughout the State. Though Doctor Peabody's

1 "Selim Hobart Peabody" by Katherine Peabody Girling, page 174.

influence was directed more to organizing, systematizing, and expanding the curriculum than to scholarly endeavor, the progressive alertness to modern educational aims and methods on the part of the faculty that had characterized the earlier years continued and began to be more widely known and appreciated.[1]

Table III gives the number of persons connected with the University faculty during the years 1880-1891.[2]

TABLE III - NUMBER OF PERSONS ON THE UNIVERSITY FACULTY, 1880-1891

Year	Number
1880-81	28
1881-82	26
1882-83	24
1883-84	25
1884-85	27
1885-86	29
1886-87	29
1887-88	29
1888-89	30
1889-90	32
1890-91	39

University Finances - One of the greatest contributions made by Regent Peabody to the development of the University was his improvement in the financial resources of the institution. Preceding the time of his administration, the State Legislature had been strongly opposed to appropriations for anything connected with the University beyond what was legally necessary; and all of the commitments had been clearly for specified objectives, such as for buildings and shops, for museum and library purposes, and for specimen cabinets and cases, and did not include salaries for instruction.[3] Accordingly, the salaries of all the leading professors had been reduced due to lack of funds for the purpose; as some positions had become vacant they were left so, the duties being distributed to other persons; certain departments, as those of commerce, mining, and domestic science, had been discontinued; the wages of janitors and other employees had been reduced; the fees to be paid by students had been increased; and the most rigid economy was observed everywhere.

1 Historical Sketch, the Alumni Record, 1918, pages XIII-XIV
2 "Sixteen Years at the University of Illinois", page 129
3 By the terms of the Federal-Land Grant Act, no part of the federal funds could be used for the purchase, erection, or repair of buildings; and hence from the beginning, the Legislature had made rather substantial appropriations for this purpose.

At the legislative session of 1881, his first year as Regent, the Trustees, spurred on by Doctor Peabody, resolved to ask, in addition to the usual sums for shops, laboratories, library facilities, and repairs, for an appropriation of $10,000 per year for the current expenses of salaries and wages. The Legislature granted about half that amount--$11,400 for the two-year period for this purpose and for covering some of the loss suffered by the University because of the reduction in the interest on its investments. However, this contribution from the State Treasury in support of general instruction was the first real acknowledgment by the General Assembly that this was indeed the State University; and from this beginning, the instructional fund was gradually increased throughout the years, being $14,000 for the two years 1883-84, $24,000 for 1885-86, $32,000 for 1887-88, and $40,000 for 1889-90. These were large sums in comparison with the salary budgets of the preceding administration, but were altogether inadequate for the work the University was attempting to do.[1]

Regent Peabody was very active in the passage of the agricultural bill by the national Congress establishing the Agricultural Experiment Station in 1887, and of the second Morrill bill in 1890, both measures yielding the University the sum of $40,000 annually.

The total University Income for the several years of Regent Peabody's incumbency are given by bienniums in the following table:[2]

TABLE IV - UNIVERSITY INCOME[3] - 1881-1890

Year	Amount
1881-82	$129,621
1883-84	141,033
1885-86	149,678
1887-88	180,960
1889-90	237,178

Further discussion of finances, this time as it relates to new buildings, is presented in the next topic.

1 Historical Sketch, The Alumni Record, 1918, page XIII, and "Selim Hobart Peabody" by Katherine Peabody Girling, pages 173-174.
2 The Alumni Record, 1918, page XXXI
3 Includes appropriations for constructing the Mechanical Building and Drill Hall Annex, the Old Armory, and the first unit of Natural History Building.

New Buildings - During the administration of Regent Peabody, a small one-story annex was added to the Mechanical Building and Drill Hall for a blacksmith shop. Doctor Peabody's efforts in securing appropriations for other buildings is expressed very aptly in the Resolutions adopted by the University Senate in 1903, at the time of the passing of the former Regent. They read in part:

"When in 1887 application was made to the State Legislature for a Military Hall, there was little basis for hope of success, and it was a real triumph when an appropriation of $10,000 was secured for this purpose. This, small as the amount was, proved to be the beginning of a change in policy on the part of the people of the State as represented in the General Assembly towards the University. During the next session in 1889, $70,000 was appropriated for the Natural History Building. In this case it was Regent Peabody who secured the passage of the legislative enactment."[1]

The Administration takes steps to Advertise the University - During the regime of Doctor Peabody, the University undertook a campaign to inform the people of the state and even the nation regarding the facilities and possibilities of the University through its alumni and its students, through the efforts of its officers and faculty in visiting and addressing assemblies of the people, and by means of exhibits illustrating the character of its instruction and accomplishments. It was estimated that during the year 1888, the University faculty attended over 100 assemblies and delivered more than 200 addresses. The most notable of the technical exhibits were displayed at state fairs and at the great educational exhibitions at Madison, Wisconsin, and at Chicago, Illinois. In addition, they were shown for six months at the State House in Springfield, and for sixteen months at the Exposition at New Orleans.[2]

Other Signs of Improvement during Regent Peabody's Administration - In the closing years of the Regency of Doctor Peabody, the University showed increased signs of growth and prosperity, partly due to the change in the name of the institution, and partly to the election of the Trustees by the voters of the State--two facts that tended to convince the people that this was indeed the State University--and partly to the advertising campaign previously mentioned. The most concrete evidence of the change in the public sentiment that followed as a result

1"Selim Hobart Peabody" by Katherine Peabody Girling, page 173-174.
2 Report of the University of Illinois, 1888, page 211.

of these activities was the increase in the legislative appropriation for the "Drill Hall", or, as it later became known, the Armory, and the first unit of the Natural History Building, the first new buildings in a decade.

Doctor Peabody's Later Life- Regent Peabody presented his resignation on June 10, 1891, to take effect on September 1, in order that he might become Chief of the Department of Liberal Arts in the World's Columbian Exposition at Chicago. Later, he became its Acting Director General. He was connected with other similar undertakings in after years, and passed away in St. Louis, on May 26, 1903, where he was engaged in planning for the St. Louis Exposition.

The University Senate's Tribute to Doctor Peabody following his death in 1903- The following tribute concerning the work of Doctor Peabody was expressed by the University Senate following his death in 1903:

"Regent Peabody was everywhere recognized as a man of high scholarship, as an attractive writer of singularly tense and well-worded English prose, as a forceful and efficient public speaker, and as an educator in the broader sense of the term of great ability and influence. In any educational convention he attended he he was, always, without any self-seeking, one of the leaders of whom much was expected. He possessed very clear ideas upon a wide range of subjects and expressed them easily and with notable precision. He was long prominent in the Councils of the National Educational Association; and among the representatives of the so-called land-grant colleges no one had greater influence in the annual assemblies."[1]

C. THOMAS JOHNATHAN BURRILL, ACTING REGENT, 1891-1894

Early Training and Experience - Thomas Johnathan Burrill, Acting Regent from 1891 to 1894, was born at Pittsfield, Massachusetts, on April 25, 1939, and was graduated from the Illinois State Normal University in 1865. He received the honorary A.M. degree at Northwestern University in 1876, and the honorary LL. D. degree there in 1893. In addition, he received the Ph. D. degree at the University of Chicago in 1881. Professor Burrill joined the faculty here on April 20, 1868, only two months after the University opened, as Instructor in Algebra, but was soon appointed Assistant Professor of Natural History. He became Professor of Botany and Horticulture in 1870, and was serving in that capacity in 1878, when he was asked to assume, in addition, the duties of the Dean of the College of Science. In 1879, he took over on top of his other assignments, the duties of Vice-Regent. He

1 "Selim Hobart Peabody" by Katherine Peabody Girling, page 173.

carried the triple burden until 1884, when he was relieved of the position of Dean. While he was serving as Vice-Regent and as Head of his Department in 1891, he was requested to take on additional duties again, this time as Acting Regent. During the three years he served as the chief executive officer of the University, he continued to administer the affairs of his own department.

<u>The Educational Policies of Acting Regent Burrill</u> - Although his appointment as Acting Regent was a kind of <u>ad interim</u> appointment, his administration was noteworthy in many respects, as a result of which the University seemed to take on new life. The most outstanding developments in his regime for which he was chiefly responsible were as follows: the change in the tenure of professors from one year to an unlimited period,-this being almost the first act of his administration, removing a cause of unrest and dissatisfaction on the part of the members of the faculty; the appointment of numerous standing committees from the faculty, each with certain administrative duties which had heretofore been performed by the Regent, if at all, which made available in a direct and simple manner the experiences and services of all the leading members of the teaching staff; the authorization of a plan for a sabbatical year on half pay for professors, although it was recognized that there was then no money with which to carry out the plan; the establishment of new departments and the appointment of first-class men to direct them; the development of a freer student life; the creation of the office of registrar; the inauguration of the Graduate School, and its support by convincing logic and inspiring eloquence; the opening of the first session of the Summer School; and greatly improved financial conditions which allowed increases in salaries of the instructional staff and the construction of new buildings. The last four items are expanded in some detail in the following paragraphs.

<u>Student and Administration Relationships</u> - The bitter feelings that developed in the previous administration over student government and student discipline and the abolition of fraternities, were very much improved during Doctor Burrill's three-year tenure, and fraternities were allowed to re-establish themselves in the campus area. There were many difficulties to be ironed out, of course, but the

problems seem to have been handled to the general satisfaction of all groups involved. Everywhere a better spirit grew up. Students were allowed greater liberty of action and they responded with greater sanity in conduct. The student organizations became enthusiastic in their support of the institution, and the relations between students and faculty became more agreeable than they had been for several years.[1]

Organized Instruction in the Graduate School - While facilities for advanced study and for research in various lines had been offered and carried on by the University as early as 1872, and the faculty had announced courses leading to the master's degree as authorized by the Board of Trustees on May 11, 1877, organized instruction under the name of the Graduate School was first undertaken during Doctor Burrill's administration in 1892, although there was no provision made for a separate faculty. In this connection, Doctor Burrill wrote to the Board of Trustees on March 8, 1892, the following: ". . . . .it seems to me very desirable that further opportunities should be provided for post-graduate work. Almost no attention has been given to this, though even a comparatively small number of such students would materially aid in gaining outside, high repute for the University, and in giving tone and quality to the undergraduate work. Good example is an excellent stimulus . . . . . .Among other things, we should thus help to stimulate in all departments the idea and habits of research, an essential to every live teacher and the only substantial basis to scholarship and to public recognition."[2]

On March 2, 1894, the Board took another step forward when they voted to establish courses leading to the degrees of Ph. D. and Sc.D.[3]

It seems only logical now that these steps should have been taken during Doctor Burrill's tenure as chief executive of the University, for he himself, in spite of his heavy administrative duties, was always active in experimentation, and contributed many scientific discoveries of prime importance .

1 "Facts for Freshman concerning the University of Illinois", 1911, page 10
2 Taken from "U.of I. Seventy-fifty Anniversary, 1868-1943, Convocation Program, March 2, 1943".
3 The Sc.D. degree was not offered after 1898-99.

Establishment of the Summer School - The Summer School was instituted in 1894, when the first session lasting four weeks was opened on June 18, of that year, the Board of Trustees having appropriated $1,200 on March 3, to carry on this work.[1]

As stated in the 1894-95 issue of the University Catalogue: "In its summer session the University aims to offer work of university grade which shall in its character be especially adapted to the needs both of university students and of teachers in the public schools. Students who are back in their studies, or who wish to anticipate studies, and teachers who wish to broaden their knowledge and strengthen themselves in the matter of attainment, will find in the summer school of the University abundant opportunity to accomplish these purposes. The facilities for study in the branches offered, and the character of instruction, are of the best the University affords."[2]

Of the thirty-eight attending the summer session in 1894, twenty-six were teachers from schools throughout the State. Members of the regular faculty gave the instruction, and the full resources of the University plant were made available. The courses offered were those ordinarily given now in liberal arts and science and educational departments.

University Finances - One of the outstanding feature of the administration was the increased financial support through appropriations granted by the General Assembly. Regent Burrill maintained the philosophy that the University should ask for whatever funds it needed, inform the General Assembly accordingly, and leave the responsibility with that body for granting or denying the requests. From appeals made in 1893, by various groups in support of this policy, the Legislature appropriated $120,000 for instruction and $431,500 for new buildings, including $160,000 for Engineering Hall. The total income of the University was $359,144

1 In the summers of 1896-98 courses of study were conducted only at the University's Biological Experiment Station on the Illinois River. In 1899, when the regular Summer Session was re-established at Urbana, it became a permanent institution, extending at first for six weeks and later for eight weeks. In 1942, the sessions were lengthened to twelve weeks and in 1943, to sixteen weeks.

2 Page 173.

for the biennium 1891-92, and $491,941 for the biennium 1893-94.[1]

New Buildings - In 1892, during Regent Burrill's term in office, the first unit or north portion of the Natural History Building was constructed. Also during this period--in 1893--construction of Engineering Hall was begun and almost completed. Thus, by the end of his regime, there were five large buildings including Mechanical Building and Drill Hall, University Hall, old Chemistry Building, old Armory, and the first unit of Natural History Building, available for instructional purposes, and another one, Engineering Hall, was well on the way to completion, to say nothing of farm, service, and other structures of that type.

The University Faculty - The number of University faculty members during the tenure of Doctor Burrill, as indicated in the following table, increased almost fifty per cent in the three-year period as follows:

TABLE V NUMBER OF PERSONS ON THE UNIVERSITY FACULTY, 1891-94[2]

Year	Number
1891-92	43
1892-93	48
1893-94	67

Of the sixty-seven in 1893-94, twenty were connected with the faculty in engineering, of which five held the title of full professor.

Exhibit at the World's Columbian Exposition - In 1893, the University presented at the World's Columbian Exposition in Chicago, a very extensive exhibit of its work,-"by far the most extensive and most representative shown by any institution." The University was comparatively small at that time and not widely known even among the residents of our own State; and this occasion afforded a splendid opportunity to impress the citizenry with the objectives, developments, and accomplishments of their educational plant. This exhibit was displayed in the Illinois Building, a large and striking structure occupying a conspicious position which attracted great numbers of the people of the State; and the publicity thus gained by the University was a considerable factor in the subsequent rapid growth in the number of students and also in the greatly increased legislative

1 The Alumni Record, 1918, page LXXXI
2 "Sixteen Years at the University of Illinois", page 129.

appropriations the University received in the next few years.

That portion of the exhibit relating to the College of Engineering presented in much detail the work of the several departments, and attracted a great deal of attention among teachers of engineering throughout the country. It received many favorable commendations for its exhibits and for the methods of instruction employed at the University and the character and quality of the work done.

Inauguration of the Two-Year Preparatory School[1] -In March, 1894, the Board of Trustees established a two-years' course in the Preparatory School. Preparatory classes had been taught almost from the beginning of the institution, but with the anticipation that the time would soon come when such instruction might be left to the high schools. If it had seemed possible, the University would gladly have abandoned the preparatory work and have offered training only above the high-school level; but if, as it appeared, it must continue with such instruction because many high schools were not fully prepared to meet the educational demands, it had to raise the standards in order to provide for the school a more creditable place in the University's instructional program. Consequently, a principal was appointed, teachers were employed, and a course of instruction was laid out. The attendance in the Preparatory School during 1893-94 was 166.

Doctor Burrill's Subsequent Life - Acting Regent Burrill relinquished his duties as the chief executive officer of the University on September 1, 1894, but his three-year tenure had an inestimable effect in starting the University on the highway towards greater success and larger service. Doctor Burrill continued to serve as Professor of Botany and Horticulture until 1903, and as Professor of Botany from 1903 until 1912. In addition, he was Dean of the General Faculty during 1894-1901, Dean of the Graduate School during 1894-1905, Vice-President during 1894-1912, and Acting Regent again during a portion of 1904.

On June 12, 1912, at Commencement exercises, during President Edmund J. James'

1 On December 8, 1903, the name of the Preparatory Department was changed to "The Academy of the University of Illinois."

administration, the University of Illinois conferred the honorary degree of LL. D. upon Professor Burrill in recognition of his long and useful period of services to the University and the State. He retired on September 1, 1912, as Professor Emeritus of Botany with a sustaining allowance from the Carnegie Foundation for the Advancement of Teaching. On October 12, 1912, at a special University convocation, the University Senate presented to Doctor Burrill a gold medal in recognition of his outstanding service as teacher, investigator, and administrator. Professor Burrill continued to reside in Urbana, and passed away here on April 14, 1916. The avenue, bordered with elms which he planted with his own hands, and named after him by the Board of Trustees at the suggestion of President Draper, bears fitting tribute to the man who so unstintingly devoted his entire working life of almost fifty years to the interest of the University, its community, and the State.

CHAPTER III

THE PRESIDENTS AND THEIR ADMINISTRATIONS

General - In 1894, the title of the chief administrative officer of the University was changed as described later, from regent to president. The presidents, as the regents were before them, are elected by the Board of Trustees. The duty of the president is to administer the general policies laid down by the Board for the operation of the University as defined by the rules and regulations prescribed for the conduct of the institution. He makes recommendations for appointment of persons to positions of responsibility on the administrative, instructional, experimental staffs and supervises the operations of those individuals in so far as they apply to the performance of University processes. He has general responsibility for the enforcement of the University regulations, and, with the advice of the administrative assistants, prepares the annual and biennial budgets for presentation to the Board of Trustees.

Since 1894, the office of the executive head of the University has been held by six persons: viz., Andrew Sloan Draper, President from 1894 to 1904; Edmund Janes James, President from 1904 to 1920; David Kinley, Acting President from 1919 to 1920, and President from 1920 to 1930; Harry Woodburn Chase, President from 1930 to 1933; Arthur Hill Daniels, Acting President from 1933 to 1934; and Arthur Cutts Willard, President from 1934 to date. Some discussion of the events in the lives of these men and their administrations follows.

A. ANDREW SLOAN DRAPER, PRESIDENT, 1894-1904

Early Training and Experience - Andrew Sloan Draper, the fourth to assume the duties of the office of chief executive of the University, was born at Westford, New York, on June 21, 1848, and was graduated from the Albany Law School of Union College in 1871. He practiced his profession for a number of years, and served as a member of the New York State Legislature in 1881. He was Judge of the U. S. Court of Alabama Claims from 1884 to 1886, State Superintendent of Public Instruction in New York, from 1886 to 1892, and Superintendent of the Cleveland public schools from 1892 to 1894.

Change in Title from Regent to President - Doctor Draper, tendered the appointment as Regent on April 13, 1894, accepted the position on May 10, following. One of his first acts was to request the title of president instead of regent as provided in the University charter; for the title of regent as applied to the executive head of an educational institution was found to be confusing, since the term was generally used for a member of the board of control or a trustee. On the day he came to the University, August 1, the Board of Trustees gave authority for the change in title, and he assumed his formal duties as President on September 14. This event in itself served as a harbinger to announce the signal developments that were on their way for the University, and to forecast a new day for this seat of learning. The institution, especially the College of Engineering was entering a new era of expansion scarcely dreamed of in earlier days.

President Draper's Administration - The spirit and purpose that animated his administration is shown as follows in a portion of his letter accepting the appointment:[1] "To enable the University to advance to a leading position, it must have financial aid to an extent which would have surprised the last generation, for the field of University operations has broadened as the activities of the people have multiplied and become more intense. It must have adequate accommodations and liberal equipment. Its departments must be able to supply life-giving instruction to all branches of liberal learning. Its work must attract attention. It must be authoritative and command respect. It must show anxiety and ability to stimulate the common life of the people, and bring renown to the good name of the State."

President Draper Modernizes University Processes[2] - No doubt, one of the greatest contributions of President Draper towards the development of the University was his work in modernizing the University's processes of handling the finances and the physical plant -- the direct outgrowth of his genius for organization and of his outstanding ability for administration.

1 Report of the Board of Trustees, 1894, page 264.
2 Much of the material in this section is taken from "The Life and Work of Andrew Sloan Draper" by Harland Hoyt Horner, published by the University of Illinois.

In his first report to the Board of Trustees in September, 1894, Dr. Draper transmitted a letter from the University Librarian presenting in some detail the urgent needs of the University Library and suggestions for their accomplishments. The 26,000 books then in the Library had not been properly catalogued, for the Dewey Decimal System, already established in most of the well-regulated libraries in the country, had not been introduced here. No regular appropriation for library expenditures had been made. The request for funds met an early response, and conditions in the General Library were presently improved.

In December, 1894, the President directed his attention towards the improvement of the status of the University's investments and the general administration of its business processes. A committee consisting of the Governor, the President of the University and the Chairman of the Finance Committee of the Board of Trustees was appointed to present recommendations to the General Assembly for legislation that would safeguard the endowment funds held by the University by prescribing more definitely the methods of handling the funds and the kinds of securities which might be used for investments. During the next year, another committee was appointed by the Board of Trustees consisting of the President of the University and two members of the Board to investigate the business operations of the University and to formulate a report on measures that would serve to promote "greater efficiency, economy, and safety in the Management of the Material Interests of the University." After some study the Committee made its report in March, 1896, presenting its recommendations as "Rules governing the Transaction of Business, the Keeping of Accounts, and the Custody of Funds of the University of Illinois."[1] These rules promptly adopted, outlined in some detail the duties and business methods that should be followed by the Treasurer, the Business Manager, the Secretary, and others, in such manner and clarity that they are still basic in the formulated instructions prepared for the operation of the business offices of the University.

---

1 Eighteenth Report of the Board of Trustees, page 45.

Rules for the Government of the University - In 1895, President Draper prepared a set of rules and regulations for the conduct of the University in general which were approved by the Board of Trustees. These articles or "by-laws" provided for a Council of Administration, consisting of the President, the Vice-President, the Dean of the General Faculty, and the deans of the separate schools and colleges -- a body that was intended to give attention both to administrative matters and educational policies. In 1901, the by-laws were amended or revised to establish a general plan of organization and administration which has served as a basis for guidance in formulating administrative policies during all the succeeding years. These by-laws and amendments, which after 1901, were designated as "University of Illinois Statutes", defined the duties of the Council of Administration, the Senate created in 1901, and the General Faculty.

University Admission Requirements - In regard to the general University admission requirements during Dr. Draper's incumbency, and even before then, Samuel A. Bullard offered the following observation:

"There has been made for many years a gradual advancement in the requirements for admission to the University. As early as 1890, the Trustees passed a resolution to dispense with the preparatory department 'as soon as adequate provision for doing its work is made by some public or private institution located in the vicinity of the University'. It would have been done outright had not appeals from different parts of the State shown that a real hardship would operate against many boys and girls should the provision for preparatory be removed from the University. However, the advance in requirements was natural because of the higher grade of offerings constantly being added to the curriculum. The whole University influence during the decade of President Draper's incumbency was toward the elevation and higher grading of high schools of the State, and the stimulation of interest in and the increased attendance upon the high school. The articulation of the work of the high schools with the work of the University was mutually beneficial to both schools and University. The familiarity of the President with the work of the public schools throughout his native state and others made this work more easily accomplished."[1]

Inauguration of the Semester Plan - In January, 1899, the University adopted the semester plan, that is, the University divided the college year of thirty-six weeks into two equal periods. Before this, the year had been divided into three terms of 14, 12, and 10 weeks respectively. Under the latter arrangement, practically all subjects were presented five times a week during one or more terms; but

1"The Makers of the University, Andrew Sloan Draper", by Samuel A.Bullard,in Alumni Quarterly,April 1910,page 98.

under the new plan, subjects were recited one, two, three, four, or five times a week during one or more semesters. The new plan intended to bring the University in line with action taken by neighboring institutions, required 130 semester-hours for graduation instead of the 40 credits required under the old plan. It called for a violent recasting of the arrangement of the curricular subjects and the instructional program, much more than was nominally apparent in the announcement. This matter is discussed further in a later chapter dealing with curricular changes.

University Finances - During the decade of President Draper's administration "there was a very great increase in the amount of appropriations made by the State for the support of the University. This fact in large measure accounts for the many general advances made in all departments culminating in an enlargement of the whole University. For the biennium commencing July 1, 1895, the appropriation for the general expenses was $180,000 and for the following two-year periods respectively $220,000; $270,000; $350,000; and $500,000; making a total in ten years of $1,520,000. The increase in attendance and enlarged facilities for instruction and investigation justified the askings of the trustees and made necessary expenditure of this vast amount of money. The appropriations for buildings and grounds were correspondingly larger, amounting in the ten-year regime to the sum of $835,000."[1] The total income of the University during the years of President Draper's administration is shown in the following table:

TABLE VI - UNIVERSITY INCOME, 1894-1904[2]

Biennium	Amount
1895-96	$594 938
1897-98	607 632
1899-00	947 487
1901-02	1 363 716
1903-04	1 814 864

Thus we see that the financial resources during these years were more than trebled -- a trend that lent great encouragement to the instructional staff.

1 "The Makers of the University, Andrew Sloan Draper", by Samuel A. Bullard in Alumni Quarterly, April, 1910, page 99.

2 The Alumni Record, 1918, page XXXI.

Student Enrollment - During the ten years of President Draper's tenure, the increase in student registration was unusual. "The addition of new courses, the increase in the instructional force, the enlargement of the libraries and laboratories, the better means of making and registering investigations and experiments the increase in the number of highly-qualified and renowned teachers, the beautifying of the surroundings, the improvement of student environment, all aided in increasing the attendance. The professional schools and colleges whose connection with the University stimulated their individual attendance united to increase the total by a large per cent. The annual increase at the seat of learning of the University during the ten years from 1894 to 1904, was something near fourteen per cent over the preceding year even though several years of the period were years of financial stringency of considerable severity. The attendance at Urbana increased from 750 in 1893-94, to 3,100, in 1903, and there were during the latter year about 900 in the Chicago departments. This marvelous increase was not shared by the University of Illinois alone, but all the colleges and universities of the country enjoyed very unusual prosperity. So the increase appeared to be from a combination of circumstances among which was a great revival of higher education in the state and land. But it should be marked that no other State University made such a per cent of increase during the period as that made at Illinois."[1]

University Faculty -"A gradual and rapid increase in the number of capable and efficient men in the instructional force was made necessary by the expansion of all departments; and no less important and gratifying was the advancement made by those members of the faculty who had been for years in the employ of the University, in ability to plan, perfect, and make practical the enlargement of their several departments."[2]

---

1 "The Makers of the University, Andrew Sloan Draper," by Samuel A. Bullard in Alumni Quarterly, April, 1910, pages 98-99.

2 Ibid., page 97

The number of members on the faculty during this regime is indicated in the following table:

TABLE VII - NUMBER OF PERSONS ON THE UNIVERSITY FACULTY-1894-1904[1]

Year	Number	Year	Number
1894-95	80	1900-01	242
1895-96	84	1901-02	279
1896-97	170	1902-03	316
1897-98	184	1903-04	351
1898-99	194		
1899-00	229		

By observing the Table, it becomes apparent at once that another one of the outstanding services rendered by Doctor Draper was the increase in the size of the faculty. It was not merely an improvement in numbers, however, for many in the group assembled were distinguished and prominant leaders in their particular lines, representing a great diversity of interests, for this was an age of specialization.

Improvement of the Physical Plant - Due to the efforts of President Draper, the University created a new heating, lighting, and power plant, and a water-supply system. A fire station was established to be operated by a trained corps of janitors. The University grounds were lighted and campus policemen were assigned to duty for both day and night service. Walks were built on the campus and the principal streets through and around the campus were improved. The athletic playground, later known as Illinois Field, was extended, improved, and enclosed by an iron fence. A system of clocks and bells operated by electric power was provided to mark the time for assembly and dismissal of classes.

These events, though some of them small in themselves, were clear indications of the internal growth that was going on during the period of transition from a small to a great center of learning. They represented some of the outward manifestations of the coming of a new era for the University.

Provision for Separate Administration of the Physical Plant - Due to his desire that the design, construction, and maintenance of new buildings and other elements of the physical plant should follow some orderly plan and receive consistent attention, President Draper requested in 1895, that the Board of Trustees

1 "Sixteen Years at the University of Illinois", page 129.

establish the office of Superintendent of Buildings and Grounds. This was done; but as the duties of the office multiplied, it seemed advisable to increase the size of the staff of the Physical Plant. Accordingly, in 1901, the Board of Trustees provided for a Superintendent of Buildings who should have charge also of the central heating, light, and power plant and of the water-supply system, and a Superintendent of Grounds, who should be responsible for the maintenance of the grounds within the campus area. (At that time, though, the buildings on the campus were still being designed by the Head of the Department of Architecture or by an outside architect called in for some particular assignment). This new operating arrangement was the product of specialization in industry allowing one group attached to the University to devote its entire attention to the administration of the physical plant proper, and the other, a much larger group, likewise employed by the University, to concentrate on problems of education and research, the main objective assigned to the institution.

<u>New Schools and Colleges</u> - "President Draper early gave approval to the contention of many friends of the University that while the University was regarded primarily to educate those persons preparing themselves for industrial vocations, it was not doing its whole duty so long as it confined its endeavors within those limits. To extend instruction into the old professions would give to the University increased honor and influence and benefit classes of people who were as deserving of the State's beneficence as others. To these ends conferences were early held with the trustees and faculty as to the best means of beginning departments of law, medicine, and teaching."[1]

The results of these studies materialized within the next few years into the establishment in 1895, of the School of Music out of the Department of Music with a separate faculty and administration; the acquiring in 1896, of the Chicago College of Pharmacy, which had been founded as a proprietary institution in 1859, and organizing it into the School[2] of Pharmacy of the University of Illinois; the organization of the School of Law in 1897, which in 1900, became the College of Law;

1 "The Makers of the University, Andrew Sloan Draper", by Samuel A. Bullard in the Alumni Quarterly, April, 1910, pages 96-97.
2 It became the College of Pharmacy in 1932.

the taking over by affiliation in 1897, and afterwards by purchase of the College of Physicians and Surgeons of Chicago, incorporated in 1881, as a privately-owned institution, which in 1900, became the College of Medicine;[1] the absorption in 1897, of the School of Library Economy at the Armour Institute of Technology and making it the Library School; and the taking over by affiliation in 1901, of a dental unit in Chicago formed in 1892, as the Columbia Dental College and designated in 1898, as the Illinois School of Dentistry.[2] In addition, the General Assembly made a special appropriation in 1901, to establish courses in business training. The University initiated the courses in Business Administration as a Department in the in the College of Literature and Arts, transferring them later, (1915), to the newly-created College of Commerce and Business Administration.

Thus, the broadening of the University by the establishment of the many new schools and colleges, was probably the most prominent feature of President Draper's administration, even though some of the preliminary preparation had been made during the previous regime. Truly, the University was taking on the proportions of great educational centers.

New Buildings - In addition to the new power plant and water-supply system, a number of other buildings were completed during the ten-year administration of President Draper. Among these were Engineering Hall, 1894; Machinery Hall (now Machine Tool Laboratory), 1895; Mechanical and Electrical Laboratory (now part of the Electrical Engineering Building), 1898; Wood Shop, 1902; and Laboratory of Applied Mechanics (now part of the Electrical Engineering Building), 1902, in the Engineering group -- the latter two to replace the Mechanical Building and Drill Hall destroyed by fire in 1900. In addition, several other main buildings erected during this period, included the Library (now Altgeld Hall), the original Agricultural building, the first unit of the Chemistry Building, the Astronomical Laboratory, and the Men's Gymnasium, for other groups. Thus we see that this was truly a period of remarkable building expansion, although the campus proper was still confined to a comparatively small area.

1 Its property was transferred to the University of Illinois in 1913.
2 Its name was changed to College of Dentistry in 1905.

Other Advancements - During the administration of Doctor Draper, there were many other enlargements and expansions in the University's program. "Courses of study were added covering many new activities and all the old ones were strengthened. The Agricultural College was reorganized. * * * * * * * * *** So with the Engineering College; it was enlarged in every line and strengthened by many accessions to its teaching force, and by an ample supply of apparatus and other facilities for instruction. The Engineering Experiment Station was established and provided with equipment and capable men. The sciences and languages advanced no less, though the lack of extensive manifestation made the work and increase less noticeable."[1]

Creation of the University Senate - As previously stated, the University Senate was created on September 14, 1901, to replace the General Faculty as the legislative body of the teaching and scientific staff. It was composed of the President, the Vice-President (later the Provost), the deans and directors of the various schools and colleges, Dean of undergraduates (later the Dean of Men), the Dean of Women, all other persons of full professorial rank, and such others as were in charge of independent departments of instruction or administration. The list of educational and administrative positions expanded considerably after 1901, but the general statement as given above is sufficiently broad to cover them all.[2]

Creation of the Offices of Dean of Men and Dean of Women - The office of Dean of Undergraduates and Assistant to the President was created on June 11, 1901, -- another adventure in educational pioneering. In 1901, the title was changed to Dean of Men, the first office of its kind in an educational institution in this country. The Dean of Men acts as advisor and counselor to undergraduate men; his duties include personnel work, vocational guidance in problems involving intellectual, emotional and social adjustments. The office maintains records of class

1 "The Makers of the University, Andrew Sloan Draper", by Samuel A. Bullard, in the Alumni Quarterly, April, 1910, page 97.

2 The Senate acts now as it did in its beginning, as a legislative body formulating general rules and regulations governing and promoting the educational interests of the University. It defines the general policies regarding admission to the University and to its several schools and colleges, the character of the various curricula, the schedules for the sessions and meetings, and the requirements for degrees.

attendance, class standing, health and living conditions, and social activities of fraternities, clubs, and other student groups. The office of Dean of Women, established in March, 1897, as the first of its kind in this country, serves to safeguard the physical and moral welfare of the women students in the University and to advise them in matters relating to general personal and scholastic problems in practically the same capacity as the office of Dean of Men. As so many of the old grads testify when reminiscing and recalling events of their college days both offices have served individuals and groups of the student body long and well.

Special Attention to Military Affairs - Early in his administration, President Draper set out to give military affairs a much more prominent place in University life than they had previously occupied. For example, at his inauguration he arranged that members of the regiment should be prominent in several ways, one of which was the guarding of Engineering Hall during the reception to the incoming president. This general attitude on the part of President Draper had a very helpful effect in stimulating interest in military matters. As the size of the student body grew, the military organization expanded in even greater proportion and became an even greater factor in University life.

Tribute to Doctor Draper by the Board of Trustees in 1904 - Doctor Draper left the University in 1904 to become Commissioner of Education of the state of New York. His resignation was announced in March, 1904, to become effective after a two-month leave of absence. Upon his resignation a special committee of the Board of Trustees reported on June 7, 1904, the following tribute to Doctor Draper:

"Andrew Sloan Draper became President of the University and entered upon the active duties of that office August 1, 1894. He was not experienced in college or university administration. He came from the superintendency of schools of the City of Cleveland, Ohio, which he had filled for two years, and to that office he came from the office of State Superintendent of Public Instruction of the State of New York. His experience in public-school matters and his acquaintance with school administration and maintenance, united with eminent abilities to organize men and things into an united force for the accomplishment of definite ends, were at once loyally applied by him to the end that the University of Illinois might fully accomplish the work prescribed for it by its founders and by the State. He fully believed in the work which the University was created to do. He fully believed that the University could be so organized as to do it well. He fully believed that the State of Illinois would worthily support the University when shown that it was faithfully performing that work. He did not believe, and he so expressed himself in his letter of acceptance, that he was fully qualified to take the lead in the

great work the University was to do. But he immediately manifested a clear mental grasp of the situation. He rightly comprehended the University's material conditions, the power of its Board of Trustees, the supreme importance of the work of its faculty, and the source and possibility of its financial support. This accurate view of the University was a sure basis for success.

"President Draper has been with us for practically ten years. He goes from us to take up a large work in the educational field in his native state. It is with a profound sense of what has been accomplished in, for, and by the University of Illinois during his administration that this Board received his resignation.

"During the past ten years, under the guidance of President Draper, the University has largely advanced in the following lines:

"The University has been more closely and vitally articulated with the public schools of the State.

"Its material embodiment has been regularly and systematically promoted; there has been increased support obtained from the State for the instructional force; there has been a large expansion in the courses of study presented for students; and the affiliation or the founding of the Colleges of Pharmacy, Medicine, Dentistry, and Law was accomplished.

"There has been unexcelled advance in sound scholarship.

"There has been an improved organization of the administration forces.

"There has been a phenomenal increase in the number of students attending on the instruction of the University.

"These are some of the things which have been actively promoted during President Draper's administration, which are largely due to his initiative and perseverance.

"It is the belief of the members of the Board that an equally great advance in the work of the University was promised for the next decade as the past one presents, had the President chosen to stay.

"In his parting from us we commend his work done here, congratulate the University upon the advance made during his administration, and express our confidence that he will be eminently successful in his labors in another great commonwealth."[1]

Subsequent Life of Doctor Draper - Doctor Draper maintained the same high-grade standards and efficiency in this new office that he had insisted upon as head of the University of Illinois, and was very successful in his new assignment. Already awarded the LL. D. degree by Colgate University in 1889 and by Columbia University in 1903, he was further honored with the same degree by the University of Illinois in 1905, and by Western Reserve University in 1910. Doctor Draper passed away in Albany, New York, on April 27, 1913.

---

1 Twenty-second Report of the Board of Trustees, 1904, pages 312-313.

Early Training and Experience - Edmund Janes James was born at Jacksonville, Illinois, on May 21, 1855. Following his early education at the Illinois State Normal University, he attended Northwestern University in 1873 and Harvard University in 1874. In 1875, he entered the University of Halle in Germany, and received the Ph. D. degree there in 1877. Doctor James served as Professor of Latin and Greek, and Principal of the High School Department at the Illinois State Normal University during 1879-82. In 1883, he became Professor of Public Finance and Administration at the University of Pennsylvania. While at Pennsylvania, Professor James organized and for twelve years directed, the Wharton Schoc of Finance and Economics. In 1896, he went to the University of Chicago as Professor of Public Administration and Director of the Division of University Extension. He remained there until 1902, when he was elected President of Northwestern University. He resigned that position in 1904, to become President of the University of Illinois.

President James was awarded the honorary degree of LL. D. by Cornell College (Iowa) in 1902, by Illinois Wesleyan College in 1903, by Queen's College in 1903, by Harvard in 1909, and by the University of Michigan and by Northwestern University in 1914.

President James' Administration[1] - Doctor James was elected President on August 23, 1904, but did not take up his duties on the campus until November 5, following. He was formally installed on October 16, 1905,--the installation being a very brilliant and colorful affair. His administration was particularly noted for his skill and energy in persuading the General Assembly to a more generous support of the University, in instituting new departments and securing outstanding men to take charge of them, and in stimulating research work. The requirements for admission were advanced for all departments; and the number and variety of curricula were materially increased. The number of volumes in the Uni versity Library increased from 66,000 to 420,000,--a very good criterion for

1 Much of the material that relates to President James' administration, was taken from his publication "Sixteen years at the University of Illinois."

gaging scholastic growth and strength. Other signs of advancement are presented in the next few pages.

Formal Organization of the Graduate School - Following its formal inception in 1892, the Graduate School through subsequent years gradually expanded its facilities to meet the ever-increasing demands of its students, drawing its financial support from the general University fund. In 1906, however, during the early years of Doctor James' tenure as President, the School began to assume a more important role in the training program. It was organized with a separate faculty under a dean in order to promote a greater development of interest in independent work and in the conduct of academic and experimental research. By action of the Board of Trustees, the teaching faculty of the Graduate School was made to include all members of the University faculty who gave instruction in graduate courses. The work was substantially increased and broadened through a legislative appropriation in 1906-07 of $50,000 a year -- the first for such work in this country -- and it has continued to receive a proportionate consideration in the formulating of all budgets since that time. The School was formally opened on February 4 and 5, 1908, the occasion being marked with much publicity. One of the addresses was by Robert W. Hunt, the famous engineer, who spoke on "The Value of Engineering Research." Another one of interest to engineers was by W. A. Smith of the Engineering Review on the subject "The Need of Graduate Courses in Engineering."

Even in the early days, the Graduate School inspired many persons to carry on advanced study in preparation for teaching positions in the colleges and public schools of the State. In research it served the arts and sciences in doing for them the same kind and grade of work that the Engineering and Agricultural Experiment Stations were doing in their special fields in discovering new facts and thereby adding to the general store of human knowledge along those particular lines. In 1915, Dean Kinley, later president of the University, stated:[1] "In its character and aim, graduate school work is really professional, for a graduate

1 Illio, page 79.

school is a school where work, coming after the general education of the college course, furnishes that deeper insight into knowledge and that thorough and earnest training which mark the student who is working with a purpose." Further attention to the Graduate School as it pertains to engineering is given in a later chapter in this publication.

The Mill-Tax Law - While the biennial appropriations by the Illinois General Assembly seemed to be generous in many ways, the amounts were not sufficient to meet the needs of a growing state like Illinois and to place its chief educational institution on an even footing with similar schools in neighboring states. Accordingly, in order to raise the appropriations to a level consistent with Illinois conditions, President James undertook a state-wide campaign more elaborate than those carried on in previous years, to bring to the people of the State in general and to the members of the General Assembly in particular, some realization of the advantages that would accrue if the facilities and opportunities of the University could be expanded. As the plan worked out in practice, influential farmers and officers of agricultural associations expressed their appreciation of the instruction and investigations by the College of Agriculture, and also their opinion that the largest development of agricultural interests of the University and of the State demanded a liberal support for the entire institution. The State Bankers' Association urged the establishment of a College of Commerce and Business Administration. The Illinois Society of Engineers, the State Manufacturers' Association, and the Western Society of Engineers recommended generous support for the College of Engineering and the Engineering Experiment Station. The Clay Workers' Association asked for a building and equipment for Ceramics. Associations of railway officials urged appropriations for railway engineering. The teachers of the State asked for a College of Education. The Governor, Charles S. Deneen, took a keen interest in the University; and in his annual message to the legislature in 1911, presented a more complete review of the needs of the University than he had in any former message, and called attention to other functions that the University might perform for the advancement of the industrial and

educational interests of the State. President James presented at Springfield, and published through the State, figures which contrasted in terms of wealth and population the support Illinois had given its State University, with that which neighboring states were giving to their chief educational institutions and showed that in proportion to both population and wealth, the State of Illinois was much behind in its support of higher education. It was a dull legislator who did not appreciate the demands of the people for a liberal support of the State University; and consequently on June 13, 1911, the mill-tax law was passed without serious opposition. The measure gave the University a tax of one mill on each dollar of the assessed value of the taxable property of the State.

After the mill-tax law became operative, the University received $4,500,000 as a biennial appropriation in 1913.[1] This epoch-making law in its first two years not only gave the University over a million dollars more than the preceeding biennium legislative appropriation, but also gave a more stable income and thus enabled the authorities to plan more intelligently for the future development of the institution. This law gave the University an income the equal of any educational institution in the world, and one that would increase with the growth of the State in wealth. It was generally believed that "this law made the University's financial future forever reasonably sure."

The mill-tax law directed that the tax should be paid into the state treasury and remain there until appropriated to the use of the University. It was still necessary for the University to present a biennial budget; but there was no longer the necessity for a strenuous campaign before the legislature, no longer any need to enlist outside influences, no longer any serious uncertainty as to the future of the University.

---

1 The Biennial State Appropriations for the past decade had been as follows:

1901	$804 330
1903	$1 152 400
1905	1 414 535
1907	2 222 790
1909	2 313 500
1911	3 429 300

Some apprehension was felt for the mill tax, when in 1912, a change in state politics brought a democrat to the governor's seat, since a change in political parties often brings a change in policy; but Governor Dunne showed himself a firm friend of the University. In 1913, weak attempts were made to repeal the mill-tax law or to reduce the rate, and also to impose on the mill-tax fund the support of the State Water Survey, the Geological Survey, the State Entomologist's office, and the State Laboratory of Natural History, all of which had been supported by independent appropriations, although located at the University; but all such attempts proved abortive.

From 1913 to 1919, the proceeds of the mill tax increased $400,000, and kept pace with the more urgent needs of the University; and during this period, the institution had no other state support than the mill tax. But in 1919, owing to economic disturbances arising from World War I and the consequent rise in prices of labor and supplies, particularly coal and wages of care takers, it was necessary to increase the legislative askings; and the appropriation from the general reserve for that year was $438,000 more than the proceeds of the mill tax. Such appropriations in later years exceeded the mill tax in even greater ratio.[1]

<u>Total University Income 1904-20</u> - The total University income from all sources from 1904 to 1920 was as follows:[2]

TABLE VIII - UNIVERSITY INCOME 1904-1920

Year	Amount
1904-05	$ 858 698
1905-06	1 159 363
1906-07	1 007 009
1907-08	1 408 762
1908-09	1 693 999
1909-10	1 639 792
1910-11	1 560 040
1911-12	2 292 651
1912-13	1 970 073
1913-14	2 770 184

1 In 1921, when a state law changed the assessed value from one-third to one-half, the tax for the University was changed from one mill to two-thirds of a mill for each dollar of valuation.

2 From "Sixteen Years at the University of Illinois", page 30, and Reports of the Comptroller.

Year	Amount
1914-15	2 808 352
1915-16	3 023 375
1916-17	3 240 388
1917-18	3 081 055
1918-19	3 312 349
1919-20	3 916 249

The total income for the year 1919-20, for example, was supplied as follows:

From U. S. Government	8.0%	$313,527
State Appropriations	73.3%	2 871 500
Student Fees	9.0%	353 684
Departmental sales, gifts, etc.	9.7%	377 538
Total		$3 916 249

New Colleges - In 1905, the Board of Trustees organized the courses in Education previously given in the College of Literature and Arts and established a School of Education, which in 1918, became the College of Education.[1] In 1913, the College of Literature and Arts and the College of Science were combined to form the College of Liberal Arts and Sciences. In 1915, the courses of instruction in business practice previously given in the College of Literature and Arts and later in the College of Liberal Arts and Sciences, were organized to form the College of Commerce and Business Administration, as previously mentioned.

New Buildings - Many important buildings were erected during President James' administration, including the following: Mechanical Engineering Laboratory; Woman's Building; Auditorium; Physics Laboratory; Matthews Avenue Power Plant; first unit of Lincoln Hall; Commerce Building; Locomotive Testing Laboratory and Reservoir; Transportation Building; Mining and Ceramics Laboratory; Floriculture, Plant Breeding, and Vegetable Gardening Group; Stock Judging Pavilion; New Armory; Administration Building; Chemistry Addition; Ceramics Building; Vivarium and Women's Residence Hall. Besides these large structures, several minor buildings were erected and a number of additions were annexed to units already existing. Furthermore new Medical, Dental, and Pharmacy buildings were erected in Chicago. The total cost of the improvements in buildings during this administration was $3,246,421.

1 The Bureau of Educational Research, the experimental agency of the College of Education, was also established in 1918.

Thus, the building program that began to accelerate during the previous administration continued to go forward at a rapid pace during this regime, giving the campus area the appearance of a great educational establishment. The equipment that went into these twenty or more structures required an endless amount of time for design and preparation and a huge outlay of money for purchase and installation. There was no other recourse available, however, for the hordes of students that began to throng the campus made the investments imperative.

The Urbana Campus Plan - In 1907, the Board of Trustees created the office of Supervising Architect which should have charge of all building construction and maintenance on the Urbana campus. About that time there was begun a systematic study of campus plans by architectural and planning experts looking towards a long-range program of physical-plant development that would provide for the consistent and orderly growth of the educational and experimental requirements of the University in the years to come. Out of the master plans outlined then or shortly thereafter and revised from time to time as occasion has required, was evolved the present-day arrangement of grounds and buildings within the campus area.

General Educational Policies of President James' Administration - In his installation address given on October 17, 1905, President James made the following statement: "It (a state university) should be as universal as the American democracy, as broad, as liberal, as sympathetic, as comprehensive -- ready to take up into itself all the educational forces of the state, giving recognition for good work wherever done, and unifying, tying together all the multiform strands of educational activity into one great cable whose future strength no man may measure."

President James, himself a great scholar and educational statesman, was a profound believer in the philosophy that the destinies of a university were determined largely by the creative scholarship and by the extent and character of the experimental and research programs of its instructional and experimental staff. It was under the influence of his inspirational leadership in this direction that the University was enabled to attain and maintain a high-ranking position among the great educational institutions of the country.

On March 11, 1915, in an address to the students on the occasion of the forty-eighth anniversary of the opening of the University, President James stated: "The distinctive purpose of a University is to train young men and women for the highest kind of service in all of the vocations of life for which a scientific training may be valuable, and to inspire them at the same time with the very highest ethical and moral ideals, and fire their hearts with an ambition to do great and real social service. And its equally important function is to add to the sum total of human knowledge and our power over the forces of nature, an activity which is sometimes characterized as research or investigation, promoted by the spirit of productive scholarship on the part of every member of the staff. If the University fails in either respect it fails of being a university in the highest sense of the term. And in working toward this ideal the University of Illinois has as great an opportunity to advance in the next fifty years as it has during the last fifty."[1]

At a later date, President James wrote the following message to the Alumni of the University on the occasion of the publication of the 1918 issue of The Alumni Record:

"We are entering upon a new era of human history. The demands to be made upon the University will be many, some of them of an entirely new character. To meet them properly will call for a new type of professor and trustee and alumnus, men and women not merely of good training and with the culture of the past, but above all, men and women of vision and outlook. Our children and our children's children will not rest content with having stretched over them the dead hand of the past.

"The University must lead in all the paths of progress if it is to win and maintain that position of influence in our future development which we university people think should belong to it. At the same time, it is doubly necessary in this era of changing standards that all that is good and beautiful in the past should be preserved and made the permanent heritage of our successors. In this work of conservation the University is by its very nature peculiarly fitted to play a permanent and even a decisive part."[2]

The University Faculty - That President James was meticulous in the selection of the faculty members is indicated by the following observation:[3]

---

1 Alumni Quarterly, April, 1915, page 95.
2 Preface, The Alumni Record, University of Illinois, 1918, page V.
3 "Sixteen years at the University of Illinois", page 146.

"No other feature of a university will so largely determine its strength as will the men who are charged with the direct conduct of its various activities. Abundance of land, numerous and spacious buildings, well-equipped laboratories and libraries and large revenues will not singly or all combined insure for a university either strength or progress. In the final analysis it is the personnel of the faculty that will chiefly determine the value of the university to the commonwealth and its rank among its sister institutions of learning.

"The increase in the number of the instructional and administrative staff of the University during the past twelve years has been a matter of necessity, in response to a steadily-increasing enrollment of students. An increase in the actual strength of the faculty, from the standpoint of scholarship and teaching ability, could, however, come only as a result of the exercise of the greatest care in the selection of individual instructors. Throughout the sixteen years from 1904 to 1920, whether a candidate was to occupy an important or a minor position, thorough consideration has been given to his scholarship, his ability to impart information and to inspire active efforts on the part of his students, his personal character and his own activity as a thinker and a producer of that which would add to the world's store of knowledge. One college of the University after another has been thus strengthened, until at the present time there is probably no department in which the work done is not of a distinctly high grade and no department in which a student may not come under the instruction of one or more of the country's leading scholars in that field of study."

The number of University faculty members of all grades increased from 351 to 943 during the administration, as shown by the following table:

TABLE IX NUMBER OF MEMBERS OF THE UNIVERSITY FACULTY 1904-20[1]

Year	Number
1904-05	351
1905-06	408
1906-07	442
1907-08	472
1908-09	497
1909-10	538
1910-11	555
1911-12	583
1912-13	587
1913-14	764
1914-15	777
1915-16	821
1916-17	868
1917-18	843
1918-19	800
1919-20	943

Revision of the University Statutes - In 1908,[2] the University Statutes adopted in 1901 and 1902, were extensively modified and amended to meet current conditions, although they followed the pattern of the previous issue. The changes

1 "Sixteen Years at the University of Illinois," page 129.

2 Approved by the Board of Trustees on December 28, 1908.

and developments within the University during that period of rapid growth made necessary a number of revisions in order to define more specifically the duties and powers of certain administrative bodies and offices.

Change in the Class-Intermission Period - Early in the history of the University, the intermission period between classes was fixed at five minutes. As the number of buildings was few and the distances between the buildings was rather short, this gave sufficient time for the students to meet their several class appointments within the campus area. As the number of buildings increased and distances increased correspondingly, however, the intermission time allotted became relatively short. On January 4, 1910, it was changed from five to ten minutes, the classes being called to order on the hour and dismissed after a session of fifty minutes. This interval seemed sufficient in the days following the change to allow the students to pass between classes in an orderly and unconfused fashion, but as the distances increased to somewhat greater proportions, the coming and going sometimes seemed a little strained. The length of the period, however, remained unchanged.

The Academy Discontinued - The Preparatory School, which was begin in 1868, and which on December 8, 1903, was designated as "The Academy of the University of Illinois", was discontinued in June, 1911, upon recommendation of the University Senate, for it was felt at that time that the high schools of the State were adequately prepared to meet the University entrance requirements. It was the intention of the Senate that in place of the Academy, there should be established a model training, experimental, and observational school of the secondary grade, which would serve as a laboratory for the School of Education under the control and direction of that School.[1] The attendance of students registered in the Academy was 309 in 1910-11.

Inauguration of the University of Illinois Press - While a continuous program of publications had been maintained by the University since 1900, when a general

1 The secondary-grade school was established in 1919 in a separate building, as a model high school under the direction of the College of Education.

series of "University Studies" was begun, there was no central agency for coordinating and carrying on this work until 1918, when the University of Illinois Press was established as an institution for editing, printing, and distributing the publications of the University itself. The list of publications now issued by this agency includes scholarly serials and monographs issued under the auspices of the Graduate School, and such other serials as the Annual Register, announcements of courses, announcements of schools and colleges and extension services, publications of the Engineering Experiment Station, and corresponding publications from the other schools and colleges on the campus, and the Bureau of Institutional Rdsearch.

The advantages of such a central plant on the campus area are obvious, of course, for its establishment under local University control conserves much time and expense, permits a better and greater output of product, and coordinates all effort towards a common objective.

Later Biography - President James was taken seriously ill in the spring of 1919 and was given a leave of absence until September 1, 1920, He did not recover sufficiently, however, to resume his duties as President, and resigned to become President of the University of Illinois, Emeritus. He spent the last five or six years of his life in California, and passed away there at the home of his sister in Cavina on June 17, 1925.

President Kinley's Eulogy - The following excerpts from the address by President Kinley at the Memorial Services held in the University Auditorium on June 22, 1925, seem very appropriately to summarize the administration of President James:

"He set new standards of scholarship, inspired new enthusiasm for the higher scholarship, gave new dignity to the scholarly life, and new enthusiasm to students' ambition. He raised the standard of work of our professional schools and put the University in its place among the scholarly institutions of the land, so that it was recognized by its associates which had developed the higher grade of University work, as deserving a place in their ranks. He reorganized the work offered for higher degrees, particularly the doctor's degree, reconstructed the Graduate School, making it a separate group, and giving its work an impetus that led the University of Illinois into recognition as one of the great graduate institutions of the country. He threw the weight of his great influence to the strengthening of the spirit and ideals of culture as well as of scholarship; of learning as well as of research; of the perfection of the scholarly life as well as of the rugged strength of the pioneer research after truth.

"In all his spheres of activity; in every one of his varied lines of service, he stood conspicuous for his gift of leadership, his high standard of work and achievement, his vision and his ideals of social service."[1]

C. DAVID KINLEY, PRESIDENT, 1920-1930

Preparation and Previous Experience - David Kinley, Acting President from 1919 to 1920, and President from 1920 to 1930, was born in Dundee, Scotland, on August 2, 1861. He received the A. B. degree from Yale University in 1884, and from Johns Hopkins in 1892. He received the Ph. D. degree from the University of Wisconsin in 1893, and the honorary degree of LL. D. from that institution in 1918. He served as teacher in Johns Hopkins University, Baltimore Woman's College and the University of Wisconsin during 1891-1893. He came to the University of Illinois in 1893 as Assistant Professor of Economics. He was Professor of Economics and Dean of the College of Literature and Arts from 1894 to 1906. He was Director of the School of Commerce from 1902 to 1915, Dean of the Graduate School from 1906 to 1914, and Vice-President of the University from 1914 to 1919.

During these years, Professor Kinley was active in the American Economic Association and kindred organizations, writing several books and reports and contributing numerous articles to society proceedings and periodicals. He was a delegate to the Second and also the Fourth Pan-American Congress and was Minister Plenipotentiary and Envoy on a special Mission to Chile in 1910.

The most significant work at the University of Illinois of Doctor Kinley before he became President was the reorganization of the Graduate School, and the securing for it, in 1907, of an appropriation of $50,000, the first special appropriation for such purpose in the State, and probably the first in the country. Two years later, largely through his efforts, legislative appropriation of $100,000 was received for the Graduate School and liberal appropriations subsequently followed. Of only slightly less importance, though, was his contribution towards the development of the College of Commerce and Business Administration, for he was largely responsible for the growth and expansion of this College to its present position.

---

1 "Memorial Service for Edmund Janes James", pages 18-19.

Outstanding Trends and Events of President Kinley's Administration - When President James was taken seriously ill in the Spring of 1919, he offered his resignation; but instead of accepting it outright, the Board of Trustees in June of that year appointed Doctor Kinley as Acting President. After a year's leave of absence from active duties, President James again submitted his resignation, which was accepted to become effective on August 31, 1920. Doctor Kinley then became President, his formal installation on December 1 and 2, 1921, being made a ceremonial occasion. A few of the outstanding events of his administration are discussed briefly in the following sections.

University Finances - Probably the most significant feature of Doctor Kinley's[1] incumbency as President of the University was his ability to instill into the minds of the officials and people of the State greater confidence in the potentialities and greater vision of the purposes and possibilities of the University and to secure correspondingly greater appropriations to consummate his purpose of developing a great institution.

In 1921, owing to the constantly-increasing number of students and to the consequent need for new buildings, and also to the necessity of increasing salaries of instructional and research staffs to meet the increased cost of living due to World War I, President Kinley asked the legislature for $10,500,000, and claimed that an adequate and comprehensive development of the University would require that amount for each of the next five bienniums. He stated that at the beginning of this decennial period a considerable part of the appropriation was needed for the past-due buildings, and that as the decennium progressed a less proportion would be required for a building program and more for maintenance, instruction, and research. The legislature voted, without a dissenting voice in any committee or in either house, the sum asked for, thus virtually approving the President's program for the decennium; but the Governor vetoed $1,600,000 for buildings.

In 1923, President Kinley presented the same plan and the same program as two years before, and again asked for $10,500,000; and the legislature once more voted

all that was asked, and this time the Governor promptly signed the bill as passed. It is interesting to note, that the appropriation of 1921 as received by the University was $3,400,000 more than the proceeds of the mill tax; and in 1923 the appropriation was about double the amount from the tax. That the representatives of the people should vote such magnificent sums to an educational institution is indisputable proof that the people of the State have implicit confidence in the work of the University, in what it is doing, and in the possibilities of the future advancement through it of the various industrial and social interests of the great commonwealth.

The total operating income from all sources for the University from 1920 to 1930 was as follows:

TABLE X UNIVERSITY INCOME, 1920-1930[1]

Year	Amount
1920-21	$3 771 046
1921-22	5 283 838
1922-23	6 310 896
1923-24	5 667 870
1924-25	7 795 067
1925-26	6 137 593
1926-27	7 825 790
1927-28	7 730 843
1928-29	6 926 602
1929-30	7 115 864

The rapid strides of the University are further reflected by the fact that the total income was practically doubled during this ten-year regime. These figures apply only to the operating income and do not include any special appropriations made for new buildings or major additions.

Educational Policies - President Kinley continued to uphold the established traditions and the high educational standards of the University, to emphasize the value of graduate work, and to stress the importance of scientific research --the Bureau of Economic and Business Research, the experimental agency of the College of Economics and Business Administration, having been established in 1921. In the University of Illinois Bulletin, Volume XVIII, No. 10, November 8, 1920, Doctor Kinley stated: "The first and most important work of the University is to train

1 Annual reports of the Comptroller.

young men and women to develop character, to make them future servants of the people in leading the way in cultural ideals and the economic and social practices that go to make up progress.

"But leaders must give out truth. The second great work of the University, therefore, is to discover new truth. It is the people's agency of research. As has been remarked before, if the University did no teaching work, it would justify the appropriations made to it by the results of its research."

In his inaugural address on December 2, 1921, President Kinley made these observations regarding the relations between the University and the State: "It is one of the glories of the State of Illinois that it has made its University free. Its Trustees are the direct representatives of the people and are free to go back to the people at any time for instruction and support. The representatives of the people in the legislature loyally support their institution. One of the wonders of our history is that the State Legislature has always been so generous and so ready. We are held to strict accountability, of course, and we are glad to be so held. But in the discharge of the duties entrusted to us, no institution could be freer from political control."

President Kinley took the necessary steps to increase the operating budget, to strengthen the teaching and research staffs, and to provide new buildings and equipment for a rapidly-expanding student enrollment. One of these buildings was the first unit of the new Library. The buildings that offered the greatest relief to the College of Engineering were Architecture and Kindred Arts and the new Materials Testing Laboratory, later renamed the Arthur Newell Talbot Laboratory. The list of new structures included two that were especially designed to serve the general student body for recreational purposes -- the Memorial Stadium and the Men's Gymnasium, later designated the George Huff Gymnasium, used not only for physical-training programs, but also for social gatherings and general University functions and assemblies. Other new buildings of general University interest were the McKinley Hospital and the Radio Station W-I-L-L.

<u>Organization of the School of Journalism</u> - In 1927, the instructional work in

Journalism, which was begun in 1902 as a part of the courses in Rhetoric, and which after 1916 was administered as a division of English in the College of Liberal Arts and Sciences, was reorganized and expanded to form a separate unit -- the School of Journalism -- under the supervision of a Director. The School offers three curricula which consist of two years of professional training after two years of college work as prerequisite. The editorial curriculum prepares students for positions as editors and reporters, the advertising curriculum, for positions in the advertising in radio and commercial work, and the publishing curriculum, for positions in the administrative phases of journalism.

The University Faculty - The number of University faculty members during the administration of President Kinley is shown by the following table:

TABLE XI - NUMBER OF PERSONS ON THE UNIVERSITY FACULTY, 1920-1930

Year	Number
1920-21	973
1921-22	1 104
1922-23	1 161
1923-24	1 192
1924-25	1 260
1925-26	1 313
1926-27	1 426
1927-28	1 382
1928-29	1 454
1929-30	1 498

The rapid growth and development of the University is further reflected in the figures here given, the increase in numbers being over 50 per cent in the ten-year period. President Kinley continued the policy of maintaining the highest grade of staff possible with the resources available for the purpose. He brought in many men of eminence to fill new positions in administrative and professorial ranks and selected young men of unusual promise for positions demanding good training but less educational experience. He was unrelenting in his search for the best he could get.

Events of President Kinley's Later Life - In 1930, President Kinley reached the age limit fixed by University regulations and was retired with the title of President and Professor of Economics, *Emeritus*. Until his death on December 3, 1944, he continued to live in Urbana, making his home in the property he occupied while

serving as President. Almost to the end he kept up his interest in community, University, and State affairs, for in 1931 he served as special delegate to the Orient for the Century of Progress Exposition in Chicago and during 1932-40, as Chairman of the Board of Directors of the First National Bank in Champaign.

President Willard's Eulogy - The following tribute by President Willard as recorded in the Urbana Evening Courier of December 4, 1944, presents an excellent summary of Doctor Kinley's life work:

"Few men in educational administration have had the opportunities to serve in so many capacities. All of his services were performed unselfishly and with a devotion to ideals rarely equalled and never excelled. His memory deserves the highest acclaim and gratitude.

"Doctor Kinley was a man of many abilities in all of which he achieved distinction. As an economist he had an international reputation. He was an educational statesman of the highest order. He will long be remembered for his accomplishments as a scholar and university administrator, but most of all for his fine character. His rugged honesty, unquestioned integrity, indomitable will, and abiding faith in the University of Illinois and its future impressed his colleagues and inspired many generations of students.

"Doctor Kinley brought to the presidency of the University a background of of training and experience which was greatly needed at that time. He served as Professor of Economics, as Dean of the former College of Literature and Arts, as director of the courses in commerce which developed into the College of Commerce and Business Administration, as Dean of the Graduate School, and as Vice-President of the University. He served the University faithfully and ably for thirty-seven years. An intense devotion to his work characterized all of these services.

"His administration as President of the University of Illinois from 1920 to 1930 was a period of great development and expansion. During that time the University made a phenomenal recovery from the serious setback which all institutions of higher education suffered during World War I, and the University made rapid progress in many directions.

"Doctor Kinley enjoyed the confidence of his entire constituency -- faculty, colleagues, students, alumni, state and federal officials, and private citizens all over the country."

D. HARRY WOODBURN CHASE, PRESIDENT, 1930-33.

Early Training and Experience - Harry Woodburn Chase was born at Groveland, Massachusetts, on April 11, 1883. He received the B.S. degree at Dartmouth College in 1904 and the A. M. there in 1908. Clark University granted him the Ph. D. degree in 1910. Doctor Chase has been favored with many honorary degrees. He received the LL.D. degree from Lenoir College and Wake Forest University in 1920, from the University of Georgia in 1923, and from Dartmouth in 1925. He was granted the degree of Dr. of Humanities by Rollins College in 1931 and the Litt. D.

degree by Columbia University in 1934. Doctor Chase served as Professor of Psychology at the University of North Carolina during 1910-14, as Acting Dean of the College of Liberal Arts there during 1918-19, and as Chairman of the Faculty from January to June, 1919. He became President of the University of North Carolina in 1919 and maintained that position until 1930, when he came to the University of Illinois as President.

The Administration of President Chase - Doctor Chase assumed the duties of the office of President on July 1, 1930. A few of the ideals and events of his administration are treated in the following paragraphs.

President Chase's Educational Policies and Objectives - In his installation address made on May 1, 1931, President Chase stated: "The very complexity of the functions and problems of a state university like our own constitutes a challenge to the wisdom and the vision of us all. There is no fixed formula for the solution of such a problem. This is not the time for the pronouncement of rigid formulas in education. In this rapidly-changing civilization of ours, formulas are outworn almost as soon as they are stated. We have less need for formulas than for open and courageous minds, and for creative spirits. Institutions like the University of Illinois are pioneering in a new world. There are no maps to guide them."

In a brief statement printed in the 1932 issue of the Illio,[1] President Chase expressed his ideas regarding the purposes and aims of student training as follows:

"I think that the great thing we can do for you as students is to help you to grow up. I do not believe in things which tend to prolong unduly in universities the period of immaturity. The university is a place where people grow up mentally, morally, and emotionally. It is, it seems to me, the concern of a university like ours to train people to bear their due part in the affairs of adult life.

"I am in favor of encouraging students to assume responsibility. American life needs and requires people who have habits of individual initiative and who are able to take and bear responsibility.

"I hope it may be my good fortune to contribute to an environment which will foster liberally-educated people. Conformity to a pattern and mediocrity are the greatest foes within our gates to liberalization of the mind. The development of individuality and a well-rounded, liberal open-minded personality are the things that count enduringly."

1 Page 19.

Revision of the University Statutes - One of the early acts of Doctor Chase, was to recommend that the University Senate make a comprehensive examination of the educational processes maintained by the University with the intent of revising the statutes, particularly as they related to the educational and administrative organization of the institution. At its meeting on December 1, 1930, the Senate initiated this investigation by appointing a Committee of Nine to undertake the study and present a report of its finding for consideration. The committee promptly appointed fifteen sub-committees to inquire into different phases of the assignment. As the main committee and its sub-committees completed the various portions of their work and presented their recommendations for approval, the Senate deliberated on the proposals, substituted such changes as seemed advisable, and finally approved the amended provisions and referred them to the Board of Trustees, which adopted them during the latter part of 1931 and the early part of 1932.

Thus as finally revised, the statutes were modified to return to the University Senate some of the powers it originally held, but which had been gradually absorbed by the Council of Administration -- an advisory body organized to assist the President in matters pertaining to administrative duties -- and making each college somewhat more autonomous in its operations. By the terms of the statutes, each college was given authority to designate an executive committee to direct its affairs, such committee being composed of the dean and two or more members elected from and by the staffs of the respective colleges.

The Founding of the College of Fine and Applied Arts - For several years, there had existed in the minds of many persons the idea of a College of Fine Arts. This dream became a realization in 1931, during the regime of Doctor Chase when the Department of Architecture from the College of Engineering, the Division of of Landscape Architecture from the College of Agriculture, the School of Music, and the Department of Art and Design from the College of Liberal Arts and Sciences were combined to form a separate unit known as the College of Fine and Applied

Arts.[1] The dissociation of the Department of Architecture from the College of Engineering left a wide gap in Engineering enrollment and reduced in proportion the size of the College faculty. The change was not unexpected, however, for plans had been under way for some years in leading and influential quarters to bring it about. Under the new arrangement, nevertheless, the revised curricula in Architecture continued to include many basic courses offered by the staff in the College of Engineering.

The Founding of the School of Physical Education - The School of Physical Education, as an independent unit, was established in 1932, under the supervision of a director, by combining the Departments of Physical Education for men and for woman and the Department of Health Service. The purpose of the School is to acquaint all students with the benefits that can be obtained from physical recreation and to teach them the fundamentals of hygiene and sanitation. Special but separate curricula for men and women leading to baccalaureate degrees, are designed to prepare students for professional duty in recreational and health-service activities.

Total University Income - The total operating income of the University from all sources from 1930 to 1933 was as follows:

TABLE XII - UNIVERSITY INCOME, 1930 - 1933

Year	Amount
1930-31	$6 782 398
1931-32	6 475 211
1932-33	5 670 021

As these figures indicate, the operating income had to take a sharp reduction during the severest part of the depression period. This decline was accompanied by some reduction in staff and by a decrease in compensation for all those employed in University positions. At times, during those years, the State funds that were ordinarily available for salary expenditures, became exhausted and had to be replenished from special sales and other taxes. There were some delays in meeting the obligations, but nothing like the seriousness that prevailed among some secondary schools.

1 The Bureau of Community Planning, the research organization of the College, was established in 1934.

Number of University Faculty Members - The total number of University faculty members of all grades during the years of President Chase's administration is given as follows:

TABLE XIII - NUMBER OF PERSONS ON THE UNIVERSITY FACULTY, 1930-1933

Year	Number
1930-31	1490
1931-32	1651
1932-33	1565

The decline in numbers was brought about by the decrease in the budget during the depression years, as previously stated; but the reduction was mainly in the lower brackets, and was nothing like the cut made in most industries and commercial establishments.

Subsequent Experience - Doctor Chase resigned in 1933 to become Chancellor of New York University and has remained in that position to date. Aside from his duties as head of a great educational institution, Chancellor Chase has found time to serve on many committees and commissions delegated to undertake unusual and responsible services for the community and the Nation.

E. ARTHUR HILL DANIELS, ACTING PRESIDENT, 1933-34

Early Training and Previous Work - Arthur Hill Daniels, Acting President during 1933-34, was born October 19, 1865, at East Medway, Massachusetts. He received the A.B. degree from Olivet College in 1887, the B.D. degree from Yale in in 1890, and the Ph. D. degree from Clark University in 1893. He was instructor of Philosophy at the University of Illinois during 1893-95, Assistant Professor during 1895-99, and Professor of Philosophy after 1899. He was Acting Dean of the College of Literature and Arts during 1911-13, Acting Dean of the Graduate School during 1918-21, and Dean during 1921-33. For a number of years between 1925 and 1933, he served as Acting Dean of the College of Liberal Arts and Sciences. He was Acting President of the University during the one-year interim of 1933-34. Some of the policies and events of his administration are discussed briefly in the the following paragraphs.

Educational Policies and Philosophies of Doctor Daniels' Administration - In

a radio address made on March 2, 1934, Doctor Daniels stated:

"With the growth of the University, there has been an increase of educational advantages traditionally associated with private institutions. Although intellectual training is fundamental to all purposes of a college or a university, the citizens of this State may rest assured that Illinois is upholding the standards of conduct as well as those of thinking and scholarship."

"During the Commencement address given in June, 1934, President Daniels expressed the following educational philosophy: "You young men and women have inherited one of the noblest benefits of mankind . . . . For what you have achieved today you may thank our system of education, which is one of our country's finest traditions. Like other traditions, it springs from one of the noblest principles of political government -- the doctrine of equal opportunity for all. That we may not have fully realized this ideal does not detract in the least from its value in our social life, for ideals are seldom achieved, but they serve as goals towards which we strive."[1]

Organization of the Division of University Extension - The Division of University Extension, organized to provide instruction in certain courses by correspondence methods, was established in 1933 as the outcome of a report submitted to the Board of Trustees, in January, 1933, relating to a study that had been carried on for some time in regard to extension work and correspondence courses. This service has gradually expanded to include such other work as Visual Aids Service established in 1932, Speech Aids Service in operation since 1935, extramural courses offering instruction in undergraduate and graduate subjects since 1936, Science Aids Service since 1939, and Engineering Extension since 1941. The inauguration of this division of University activities has made valuable contributions to the citizens of the State in providing instruction in undergraduate subjects on the college level for mature students of all ages removed from the campus area, making it possible for many to carry on or continue their educational programs under conditions where no other means have been available, and in supplying materials and personnel to supplement the instructional schedules of the secondary-school systems of the State.

Establishment of the Bureau of Institutional Research - The Bureau of Institutional Research was established in the fall of 1933 as a fact-finding or efficiency agency for collecting and analyzing data with reference to various phases of University administration. Under guidance of its advisory committee, of which

1 Illinois Alumni News, July, 1934, page 364.

the Provost is chairman, the Bureau gives attention to the teaching, research, budgetary, and other aspects of University operation in their relations to one another, to educational policies and objectives, and to the social needs of the State, and formulates its interpretations and appraisals in special reports to the President of the University. In general, the agency is concerned with the development of data which may look to the systematic and economic coordination of all efforts directed towards accomplishing the purposes for which the University was established.

The Federal Emergency Relief Administration and the National Youth Administration[1] - Beginning with the second semester of 1933-34, the Federal Emergency Relief Administration, or F.E.R.A., as it was generally called, inaugurated a national program for the financial relief of needy students in the publically-supported colleges and universities throughout the country. This action was taken in view of the hardships that were being imposed upon youth by the depression period, depriving them of the normal opportunities for obtaining employment to aid in defraying their college expenses. Federal funds thus allotted to educational institutions, were assigned under the provision that they should be devoted to special work or projects that the schools could not do at that time with their own funds and that would afford employment for worthy young men and women who would not otherwise be able to get an education. A number of students, not to exceed 10 per cent of the total registration, could be selected by each institution to participate in the fund if that number was in need and could not continue without assistance.

Nearly 1,000 students at the University of Illinois benefited by this program. The maximum which any student was permitted to earn was $20 a month and the minimum was $10. The average for all students participating was not to exceed $15 a

1 The name of the relief project was changed in 1935 to National Youth Administration, or N.Y.A. as it was commonly known, but the system remained about the same. Under this plan, as under the other one, the departments were able to get many jobs done they could not have hoped to do under other conditions, and many students remained in school who would have dropped out if they had not had the help. The N.Y.A. was discontinued, however, in 1943 for lack of Federal appropriation by Congress. At that time the civilian students remaining in the University seemed to be more self-supporting than formerly; besides, the money was more urgently needed to carry on the war effort.

month. The rates of pay were those usually paid by university authorities for work of corresponding grade. The students worked on useful projects proposed by members of the staff in the different departments.

This plan proved to be extremely worth while. It rendered much-needed assistance to students and kept many of them in college who otherwise would have had to leave.

Total University Income - The total operating income of the University from all sources during 1933-34 was $5,678,447. This amount is only slightly above that for the preceding biennium, and indicates that the State was still having difficulties in meeting its financial obligations. Salaries of the staff were still down to the level to which they were cut during the previous two years. The lack of funds for library and equipment expenditures called for serious thought in placing the income where it could serve to best advantage.

Number on the University Faculty - The total number of persons of all grades on the University faculty during 1933-34 including full-time and part-time staff, was 1,522. This figure is even lower than that for the preceding biennium and indicates the financial predicament in which the University found itself at that time in trying to hold together its staff of trained personnel.

Subsequent Life - Having reached the statutory age limit, Doctor Daniels was retired in 1934 with the title of Acting President and Professor of Philosophy, Emeritus. He continued to reside in Urbana, taking an active part in University and community affairs until he passed away on April 2, 1940.

F. ARTHUR CUTTS WILLARD, PRESIDENT, 1934-DATE

Early Life and Preparation - Arthur Cutts Willard was born in Washington, D.C. on August 12, 1878, and was granted the B.S. degree in Chemical Engineering at the Massachusetts Institute of Technology in 1904. He was a teacher of industrial chemistry in the California School of Mechanic Arts, San Francisco, during 1904-1906. He then served as Associate Professor of Mechanical Engineering at George Washington University in charge of the department from 1906 to 1909; as Assistant

Sanitary and Heating Engineer, Quarter Master's Corps, U. S. Army, from 1909 to 1911; and as Sanitary and Heating Engineer in charge of preparation of plans and specifications for heating and ventilating equipment at all U. S. Army Posts, including awards of contracts and acceptance tests, from 1911 to 1913. During that time he served also as consultant on the mechanical equipment of buildings. Professor Willard came to the University of Illinois in 1913 as Assistant Professor, and in 1917 he became Professor of Heating and Ventilation -- a title he held until 1934. He assumed charge of the Mechanical Engineering Laboratory during the years 1917-20, and served as Head of the Department of Mechanical Engineering from 1920 to 1934. During the period from July 1, 1933, to July 1, 1934, he served as Acting Dean of the College of Engineering and Acting Director of the Engineering Experiment Station. On July 1, 1934, he became President of the University.

President Willard's Administration - Shortly after coming into the office as President in 1934, he was honored with the degree of LL. D. by Northwestern and George Washington Universities, and with the degree of D. Eng. by Case School of Applied Science. In 1936, President Willard was the recipient of the F. Paul Anderson Gold Medal of the American Society of Heating and Ventilating Engineers.[1]

Some of the outstanding problems and events occurring in President Willard's administration are discussed in the next few pages.

Problems Anent Increased Student Enrollment - "During the period beginning with the year 1934, the enrollment of the University of Illinois increased at a rate that reached beyond anything experienced in the entire previous history of the institution. The magnitude of this growth can best be appreciated by citing some enrollment figures. For the twenty-nine years (from the founding of the institution to 1895-96) enrollment remained under 1,000 students. The year 1896 to 1897 saw the beginning of a twenty-year period during which the figures mounted steadily, with the exception of the years 1912-13 and 1917-18, to 7,000. In

---

1 Other portions of President Willard's biographical sketch appear in later chapters.

the session 1919-20, a steeper climb began which reached a climax of almost 15,000 in 1930-31, or more than 100 per cent increase in thirteen years. In the three succeeding sessions (during the depression) losses of 1,000 students a year occurred. Beginning with 1934-35, however, there was an average yearly gain of 1,000 students; the climax was reached in 1938-39 with almost 18,000 students. A highly significant fact is that of the enormous increase in students on all campuses of the University of Illinois, almost 80 per cent was in undergraduate divisions of the Urbana campus.

"Increases such as those occurring since 1934 are likely to cause certain problems to arise in educational institutions. The first of these relates to the maintenance of standards of administration under the pressure of great numbers of additional students. The second grows out of a greater diversity of interests and abilities appearing among these new students. These differences in turn require that the institution give consideration to their recognition and classification, and to the modification of the educational program to meet the new educational requirements. The third is concerned with the modification and expansion of the physical facilities and the administrative organization of the University to care for the greatly-increased enrollment. The necessity for providing for so many more students than during any previous period brings enormous stresses and strains upon the physical facilities of the institution on the one hand, and on the other upon the mechanism of educational organization and administration."[1]

Some of these problems, especially those relating to the budget and the building program are discussed briefly in the next two sections.

University Finances - The strain on the facilities brought about by the enormous increase in the enrollment of the student body demanded a corresponding increase in the budget for buildings, equipment, and teaching personnel. The total University budget increased from about $11,595,000 for the biennium 1933-35 to about $19,340,000 in 1941-43, and the total amount spent for buildings and equipment from July 1, 1933, to June 30, 1942, which include President Daniels'

1 "The University of Illinois Survey Report" by a Commission of the American Council of Education, 1943, Page 32.

administration, was about $7,959,000. These allowances during the early years of the recovery period following the depression left some funds available for increase in salaries of the regular staff, but not to restore them to their original values. Some of the later budgets did serve, however, to make up some of the deficiencies, especially among those in the lower-pay brackets.

The total operating income at the University from all sources from 1934 to 1944 was as follows:[1]

TABLE XIV - UNIVERSITY INCOME, 1934-1944

Year	Amount
1934-35	$5 787 702
1935-36	6 644 060
1936-37	6 929 335
1937-38	7 910 256
1938-39	8 179 648
1939-40	8 577 556
1940-41	9 220 021
1941-42	11 413 444
1942-43	12 309 886
1943-44	15 703 273

The income for the fiscal year ending June 30, 1943, for example was provided as follows:[2]

From the U. S. Government	21.3%	$2 356 149
State Appropriations	59.6	6 578 795
Student fees	11.4	1 258 710
Private gifts and endowments	2.5	277 042
Earnings of educational departments & miscellaneous	5.2	569 696
		$11 040 392
Gross income from residence halls, Union Building, hospital and tenant properties.		$ 1 171 444
Gifts and endowment income from scholarships, prizes and annuities		98 050
		$12 309 886

Number of Persons on the University Faculty - The total number of persons on the University faculty during the first ten years of President Willard's administration including full-time and part-time staff was as follows:

1 From Annual Reports of the Comptroller.
2 From Financial Summary of Report of Comptroller, page 5.

TABLE XV - NUMBER OF PERSONS ON THE UNIVERSITY FACULTY, 1934-1944

Year	Number
1934-35	1653
1935-36	1752
1936-37	1920
1937-38	2091
1938-39	2145
1939-40	2219
1940-41	2247
1941-42	2511
1942-43	2364[1]
1943-44	2347[1]

The demands made for research and for instruction by an ever-growing student body increased the size of the staff by practically 50 per cent during the ten-year period of this administration. No doubt, the next few years will see even greater additions when students return from military service, for the Government is planning to subsidize those who were deprived of their undergraduate training when they were inducted into the armed forces.

Educational Policies and Objectives of President Willard's Administration - The general educational ideals and policies of President Willard are clearly reflected in the following statements expressed by him in the 1936 Illio:[2]

"Unless our educated classes, whether they have specialized in the arts, literature, or sciences, have also an interest in, and an intelligent appreciation of, the social, political, and economic problems of the society in which they must live their lives, they may have received an education which they may not use effectively. The approach to these problems through the development of interest and appreciation therein depends on a sense of personal responsibility to the community and the state. In other words, we must develop a sense of citizenship if there is to be a well-balanced society in which to live and enjoy a richer life.

"Briefly stated, we have developed during the past decade or so, as a result of our amazingly-rapid advances in technological and other fields, a highly-specialized attitude towards education on the part of the students and faculty in many of our universities. Many are thinking only in terms of education for individual competence, with the result that breadth of learning, background subjects, and even cultural ideals are being sacrificed in the rush for utilitarian knowledge which is so much in demand, especially in the professional fields and in the professional schools. The fact that social and economic trends might seriously impair the usefulness of such highly-specialized knowledge has received scant consideration. Economic stability and social harmony have been taken for granted -- government would solve all such problems as might arise, relieving the individual of any responsibility save to himself and his own career.

"It is a proper function, therefore, for our state universities today to

1 Includes those on leave for War Service.
2 Page 21.

readjust the balance between education for individual competence alone, and education for breadth, for background, for cultural development, for citizenship, in order to promote the best interests of the community in which we live. The University of Illinois expects to meet this situation with frankness and deal with it without sacrificing any of those fundamental values which our educational experience has taught us apply equally well in any situation -- including the present. It is, in my opinion, equally mandatory on the University to produce men and women, who, when face to face with life in a world that is far from perfect, in a world that measures success too often by material success regardless of the means employed, will use their knowledge for the common welfare of their fellow men."

Educational Expediencies - While the educational and research policies of President Willard's administration have been, in the main, a continuation of those of his predecessors, several innovations have been adopted to keep pace with changing and advancing conditions. In 1940 there was created the Division of General Studies in the College of Liberal Arts and Sciences with the idea of promoting "anew the ideal of the 'well-rounded man'." The curriculum is designed for several types of students who enter the College of Liberal Arts and Sciences. It offers a well-balanced program in the sciences and humanities to the student who desires a general introduction to learning and culture before he enters upon specialized training. To the student with conflicting inclinations toward several professions it offers an opportunity to explore the main areas of knowledge and to test his own interests and abilities before he decides upon his life work."[1]

Another addition was the establishment of the Student Personnel Bureau as an agency to provide student counsel and advice. Its greatest usefulness is to freshmen, but it is equipped to offer advice to all students on matters of vocational aptitude and guidance and in the choice of fields of study. Furthermore, there was initiated a state-wide High-School Testing Program that supplies an important service to the colleges and high schools of the State in classifying student performance and in developing essential information for the Personnel Bureau.

Another activity inaugurated during his administration was the establishment of a state-wide Engineering, Science, and Management War Training Program by the U. S. Department of Education through our Division of University Extension to

1 "Division of General Studies of the College of Liberal Arts and Sciences of the University of Illinois," August, 1943, page 1.

serve the various war industries in Illinois. While the agency was set up to meet an emergency condition, it will no doubt continue to function in modified form. This agency is discussed at some length in a later chapter.

During this period, too, the Chicago departments were greatly strengthened by the appointment of an Executive Dean to coordinate the educational and research programs of the professional colleges of Medicine, Dentistry, and Pharmacy, by an extensive building program to accommodate their expanding departmental needs, and by effecting affiliations and cooperative working arrangements with other Chicago institutions and other state health and clinical agencies located in the Chicago area. Some of these arrangements and agencies are mentioned in the following paragraph.

Affiliations and Relations of the Chicago Colleges with other Chicago Institutions - Rush Medical College and Presbyterian Hospital in Chicago became affiliated with the College of Medicine of the University of Illinois in 1941. By an act of the General Assembly in 1941, the Research and Educational Hospital and the Illinois Surgical Institute for Children were transferred to the University from the State Department of Public Welfare, and the Division of Services for Crippled Children, formerly in that department, was placed under jurisdiction of the University. The Illinois Neuropsychiatric Institute, the Illinois Eye and Ear Infirmary, and the Institute for Juvenile Research, located on the Chicago campus, operate under an agreement between the University and the Department of Public Welfare.[1]

The affiliations of these institutions offering infinite opportunities for instruction and research to those connected with the College of Medicine, has served to strengthen the University and move it still further into the topmost rank of American Universities. The numerous clinics, dispensaries, and hospitals; the extensive library and museum collections; and the enlarged instructional and experimental staff combine facilities for study and investigation rarely equalled in this or other lands.

---

1 The Annual Register, 1942-43, page 66.

Changes in the Administrative Organization at Urbana - Effective on September 1, 1943, a number of changes in administrative organization at Urbana were approved by the Board of Trustees. One of these involved the creation of the new office of Dean of Students directly responsible to the President, to direct and coordinate the work of a number of offices, committees, and functions that relate to student life and welfare, especially those of a non-curricular nature.

Under this new arrangement, the Dean of Students supervises the activities of the Dean of Men, Dean of Women, Student Employment Bureau, University Health-Service Station, McKinley Hospital and the hospital and medical services, the division of student housing, all boards administering extra-curricular affairs except those relating to athletics and the alumni association, and all cultural, educational, and social programs of the Illinois Union and the residence halls. He is responsible, also, for the committee on Guidance Conferences for High-school students.

Under this new plan, too, there is to be an office of Business Manager, immediately responsible to the president, to direct and correlate the business affairs of the University except those assigned to the office of comptroller. The responsibilities of this new post will include purchasing and non-academic employment, and the construction, maintenance, and operation of the physical plant, the residence halls and the Illini Union Building and Illini Hall.

Building Program - The several new buildings erected during the administration of President Willard are located both on the Urbana and Chicago campuses. Thos in Urbana include: The Metallurgical Laboratory, 1936; The Natural Resources Building housing the State Geological and Natural History Surveys, 1940; The Geological Survey Laboratory, 1940; The William Lamont Abbott Power Plant, 1940; Gregory Hall, 1940: Men's Residence Hall, 1941; ~~and~~ the Illini Union Building, 1941; the Sanitary Engineering Laboratory, 1943; and the Airport Hangar, 1945. In addition there have been made major extensions to existing buildings on the Urbana Campus, the largest of which was the University Library.

Those new buildings located in Chicago include: Dentistry, Medical and Pharmacy building, 1937. In addition, there were some changes made to existing

buildings, the chief of which was for the new Chicago Illini Union Building, formerly housing a part of the College of Pharmacy.

<u>Student-Faculty-Alumni Social Centers</u> - The administration arranged to take over the old Y.M.C.A. building at Wright and John streets in Champaign and to convert it into a student center, which served temporarily to provide a nucleus of activities for the student body. Later, there was constructed the new Illini Union Building, which has served so efficiently as a social and service center for activities on the Urbana campus proper. There was established, in addition, a student-faculty-alumni center on the Chicago campus, in what has been called the Chicago Illini Union Building, to serve somewhat the same purposes as the student-faculty-alumni centers have done at Urbana. These Urbana centers are described more fully in later chapters.

<u>The University of Illinois Foundation</u> - The University of Illinois Foundation a non-profit corporation organized in 1935, under the laws of the State of Illinois, grew out of the Alumni Fund which had been started about ten years previously. Its objectives are summarized in the 1942-43 issue of the Annual Register[1] as follows:

"1, to assist in developing the facilities of the University by encouraging gifts of money, property, works of art, etc., and by such other means as may seem advisable; 2, to receive, hold, and administer such gifts with the primary object of serving purposes other than those for which the State of Illinois ordinarily makes sufficient appropriations; 3, to act as the business agent of the Board of Trustees of the University in the performing of other services specified by them; and 4, to undertake such other enterprises as tend to promote the interests and welfare of the University.

"The Foundation consists of twenty-eight members. Three of these are the President of the University, the President of the Board of Trustees of the University, and the President of the Alumni Association, who are ex-officio members during their terms of office. Three other members are elected from the Board of Trustees of the University. The remaining members are elected, for terms of three years, by the existing membership. At the annual meeting of the Foundation, nine of the members, including the three ex-officio members, are elected to serve as Directors of the Foundation."

1 Page 420

Division of Special Services for War Veterans - The Division of Special Services for War Veterans was created in 1944 to serve as an agency for receiving and counselling those veterans of World War II who are interested in continuing their University training and for supplying in so far as possible their scholastic needs. The Division operates under supervision of a director experienced in war-time veterans' service, who reports directly to the President.

Small Homes Council - "The Small Homes Council was established in 1944 for the purpose of informing the general public on matters pertaining to home design, construction, maintenance, and ownership, by means of publications and approved forms of demonstration. The activities of the Council are under the direction of an executive committee and the Coordinator. Its program includes the development and coordination of research and experiment in new fields of design, construction, materials, and human use of the home. The Council acts as an agency to coordinate the research and teaching facilities of all departments and colleges in the University whose work touches on the problems pertaining to the home, both urban and rural. It also acts as a cooperating agency with elements of the building industry which are interested in the same fields of endeavor. The work of the Council is done by a staff and by committees whose members are drawn from the faculty of cooperating departments and colleges." [1]

New College of Veterinary Medicine - In 1945, there was established on the Urbana campus the College of Veterinary Medicine. Previous to that time, the work in this particular field had been administered by the Department of Animal Pathology and Hygiene in the College of Agriculture.

Department of Naval Science and Tactics - The Department of Naval Science and Tactics was established in 1945 as an agency to continue the Navy training program set up during World War II and to administer the courses provided for the Naval Reserve Officers' Training Corps.

Institute of Aeronautics - The Institute of Aeronautics was established in 1945 as an agency to foster and correlate all of the University's educational and experimental activites related to aviation. It is administered by a Director who is chairman of an Executive Committee appointed by the President of the University from departments having a part in the program of education and research in the field of aviation.

---

1 Annual Register, 1945-46, page 494.

CHAPTER IV

GENERAL GROWTH AND ACTIVITIES OF THE COLLEGE OF ENGINEERING

The Status of Engineering and Engineering Instruction in 1870 - When definite instructional work in Engineering was launched in 1870, practice in that field was largely an art, and as a consequence, the curricula of the early technical departments came to contain many courses that were essentially manual in nature, such as shop work, mechanical drawing, and surveying. For a number of years, these courses together with mathematics and the liberal-training subjects, made up the bulk of the curricula. Like everything else, however, instruction had to begin where it found itself, and make its own experience from that elementary beginning.

Chronology of the Departments - In 1870, provision was made for instruction in "courses in Mechanical Science and Art, Civil Engineering, Mining Engineering and Metallurgy, and Architecture and Fine Arts." Instruction in some courses in Physics was given as early as 1870, but Physics did not become a separate department until 1889 -- a date marking the beginning of a period of great expansion of the College. The Departments of Municipal and Sanitary Engineering and of Theoretical and Applied Mechanics were established in 1890. Electrical Engineering became a division of Physics in 1891, but it was not made an entirely separate department until 1898. Railway Engineering was made a separate department in 1906, with three distinct curricula: Railway Civil Engineering, Railway Electrical and Railway Mechanical Engineering. In 1915, the Department of Ceramics was transferred from what was then the College of Science to the College of Engineering and became the Department of Ceramic Engineering. Some instruction in courses in drawing and descriptive geometry was offered when the four pioneer departments were organized in 1870, although a separate department of General Engineering Drawing was not established until 1921. The Department of General Engineering was also set up in 1921, while the Department of Agricultural Engineering was provided in 1931 and the Department of Aeronautical Engineering in 1944.

The Department of Municipal and Sanitary Engineering was discontinued in 1926, and the Department of Railway Engineering, in 1940.

The facilities of these several departments including the personnel, and their courses and curricula are described in later chapters.

A. EDUCATIONAL STANDARDS AND PRACTICES

Requirements for Admission to the College of Engineering - Before 1899, the requirements for admission to the College of Engineering were rather indefinite; after that, however, they were rather rigidly prescribed. From September, 1899, to September, 1903, the requirements for admission were 12 units of high-school work, and from September, 1903, to September, 1905, the number was thirteen and one-half units. During 1905-08, the number was increased to fourteen, and since 1908, it has been fifteen units. Of these fifteen units now required, three must be in English, one and one-half in Algebra, one in plane Geometry, one-half in solid Geometry, and nine from fields of general and special electives, those most favored and recommended being foreign language, science, social studies, and industrial arts.

Early Methods of Instruction - In regard to instruction methods, the 1891-92 number of the University Catalogue stated:[1]

"Whenever suitable textbooks can be found, they are employed, because saving much time in acquiring facts and data, and because such books become doubly valuable for later reference when enriched by notes and additions. But to arouse and awaken the enthusiasm of the student, occasional or stated lectures are necessary, and these are fully illustrated by sketches, diagrams, drawings, and photographs of executed works. They are frequently used in the advanced classes partly because of the deficiency of textbooks was there most apparent. Additional courses of extended reading are marked out by reference to the University Library, so that each student may enjoy the greatest possible benefit from the course of instruction. In all courses of study offered by this College, drawing, in its manifold forms and uses, is made a special feature, both in its application and its modes of execution."

Wherever possible the classroom instruction was supplemented by the use of plates and models, while the drawing-room work was in a way coordinated with shop practice in that machines designed in the drafting room were actually built in the shop by the students themselves.

1 Pages 40-41

During the lecture periods, the students took notes which they preserved in orderly form for reference and study in preparation for the quizzes and examinations that followed during subsequent periods. In addition, many instructors were able to illustrate their theory by problems which the students were required to work on their own time and to turn in for the grader's records. As soon as suitable apparatus became available, laboratory instruction was provided to supplement the classroom training. By means of these exercises which parallel the classroom assignments in so far as practicable, the students were able to verify the principles and laws of science and to apply them to specific cases. The experiments were designed to teach the use of the instruments ordinarily employed in Engineering practice, and to demand a high standard of performance, far above the level of a mere sterotyped and routine process of reading and recording data. After the investigations were completed, the students were required to formulate constructive and analytical reports summarizing the results, making their own interpretations, and deriving their own conclusions. Thus, this part of the instructional schedule was planned to provide much more than a passing knowledge of the methods in practice. It was designed to develop for the individual that quality of initiative and independence of thought necessary to turn out resourceful and successful engineers.

Changes in Methods of Instruction - During the last seventy-five years there has been a very decided advancement in the overall methods of Engineering instruction made possible by the outstanding progress in the development and expansion of the Engineering profession and the Engineering industries and, by improvements in facilities available for educational purposes, although the general objectives in training remain the same. The production of modern textbooks has made it possible to replace a considerable amount of lecture and notebook work by the more efficient home-study and recitation method, and has been a great aid to both teacher and student. Such texts have helped also to standardize the content of courses and probably to raise the standard of quality of work done.[1]

1 Bulletin 1925, No.5, Land-Grant College Education, 1910-1920, Part IV, Engineering and Mechanic Arts, pages 14-15.

The constant increase in the scope of engineering science and knowledge and in the extent and character of the applications of this science and knowledge, has made necessary the inclusion of many new specialties and much new material in the curriculum, as well as the revision of courses to include new applications, sometimes with a relocation of emphasis on matter already included.[1]

While the following quotations refer specifically to Mechanical Engineering, others similar in scope and tone typifying the progress in all other departments could be recorded with equal propriety.

"The development and general utilization of the internal combustion engine the steam turbine, and the uniflow steam engine; the great increase in the consumption of mechanical and electrical power; and the development of great central power stations have made it necessary to modify the courses in power engineering and to enlarge their scope. The introduction of improved tool steel and of high-power machine tools, and the demand for greater shop production and for the elimination of waste in industry have called for additional attention to these matters in courses dealing with shop work."[2]

Changes in course-content of the curriculum in Mechanical Engineering for example, are illustrated by the following comparison between the years 1870 and 1940:

Year	Language Humanities	Mathematics Pure Science	Drawing Engineering Subjects
1870	25%	33%	42%
1940	12%	30%	58%

"The great increase in the number of engineering students in recent years has made feasible a greater degree of specialization by teachers and by students than formerly. Special courses in industrial history, English, Physics, and the like have to a considerable extent replaced the more general courses formerly given to all college students. Similarly, the larger number of Mechanical Engineering students has made possible the introduction of more options in the senior year, without reducing the number of students in each section to too small a number for economical instruction. Curricula in industrial engineering, heating and ventilating, power engineering, railway mechanical engineering, and the like have also been introduced in a number of colleges. The larger number of Mechanical Engineering teachers required for the larger number of students has made possible the specialization of the teachers in those subjects they are best qualified to handle, and has doubtless improved the quality of instruction."[3]

A striking contrast between the instructional methods in Engineering during the first twenty-five years of the University's history with those of later

1. Ibid, page 12
2. Ibid, page 12
3. Ibid, pages 13-14

periods is in the use of laboratory equipment. Before 1893, there was comparatively little apparatus available for laboratory purposes, but through the years since then, great strides have been made in providing facilities for instructional use.

Throughout all this time, though, the dominating idea in formulating the instructional materials and the educational programs, has been to provide the best combinations of systematically-considered lectures, text assignments, collateral readings, discussion sessions, quizzes, problems, drawing-room and laboratory exercises, reports, and inspection trips that enable the students to master their chosen subjects to best advantage under the limitations imposed by University and other social conditions.

Instruction for Engineering Students Provided by a Number of Colleges within the University - The instruction in technical engineering subjects has always been given to students registered in the College of Engineering by members of this College staff. That in such subjects as mathematics, language, economics, chemistry, etc., however, has been provided by other colleges here on the University campus. Studies have been made at one time or another looking towards making the College of Engineering an autonomous or independent unit by supplying its own staff to give instruction in non-technical courses; but no appreciable change in this direction has even been effected.

The College of Engineering Faculty - The College was exceedingly fortunate in the personnel of its departments in the early stages of its development. Stillman Williams Robinson, the first teacher in the new College, was appointed Professor of Mechanical Engineering in December, 1869, and served eight and one-half years in that capacity. Among other things, he established the first strictly educational shops in the United States. His clear-cut ideas of the aims of engineering education in this country dominated the early development of the College and determined a philosophy of education still considered sound in present-day programs. Mathematical theory and scientific research were admirably blended with discussions of engineering practice in Professor Robinson's classroom and

and laboratory.

Professor Robinson was associated with and followed by a group of pioneers in this almost-new type of education -- men who had a keen vision of the possibilities of the engineering profession. Among them may be mentioned Professor Selim H. Peabody in Mechanical Engineering, and later Regent of the University; J. Burkitt Webb and Ira Osborn Baker in Civil Engineering; Nathan Clifford Ricker in Architecture; Arthur Tannant Woods and Lester P. Breckenridge in Mechanical Engineering; Arthur Newell Talbot in Municipal and Sanitary Engineering and Theoretical and Applied Mechanics; Theodore Comstock in Mining Engineering; and Samuel W. Stratton in Physics. This small group of well-trained and enthusiastic educators, motivated by serious purposes to provide the best instruction possible, gave earnest consideration to the balancing of the curricular subjects in the instructional program, as well as the requirements for admission and graduation, to the organization and presentation of instructional materials, to the proper development and use of laboratory facilities, and to the standards of student performance in their classroom and extra-curricular activities including their engineering-society programs. The impress of these early educational leaders upon engineering education in this country clearly persists to this day in many institutions and in professional service and went a long way in establishing the reputation which the College has made for itself to rank it among the foremost technical institutions in the land.

As the years went on, the size of the College faculty was increased to keep pace with the growth in industry and in numbers of the student body, "and with this increase a greater variety of talent was obtained. No longer was the wisdom and knowledge and authority on a wide range of subjects confined to one or two or three individuals in a department. With this increase in strength through development naturally came a growth in the recognized standing of this College in the various fields. Likewise the number of individuals well-trained in special lines increased. Insofar as an institution's work may be judged by the strength of its faculty, the achievements of the College may be expected to become more

valuable, more outstanding with the improvement of its personnel, especially as the quality and attitude of the student body may be expected to keep up to high grade. Something of the advances in the make-up of the institution may be judged by the development of the men having to do with instruction."[1]

In line with this educational policy, university administrators have long recognized that the most important part of a college plant is its teaching and scientific staffs -- that of little value indeed would be buildings and equipment without competent and highly-trained men to utilize them for the most constructive purpose. Such a staff, too, is the most liquid part of the educational plant as many an executive including our own, has learned to his sorrow when other institutions have lured away some of his top-ranking men by offers of increase in pay or other recognized advantage.

The type of men the University has sought to carry on its instruction and scientific work is clearly portrayed in the following comments by President James:

"With the increase of the student body it becomes necessary to enlarge the instructing corps, and with this increasing number of instructors, it becomes possible to secure a wider range of ability and preparation. This makes the University a more interesting place to work, and young men who are looking forward to a scientific career are more willing to come into it and remain a part of the staff for a longer time than would otherwise be the case. As our equipment is increased and as our libraries increase, the University becomes to an increasing extent a center of scientific research and investigation; and life in the University is increasingly attractive to the best type of aspiring, progressive, highly-trained scientists."

* * * * * * * * * * * * * * * * *

"No institution can lay claim to the title 'University' unless it is a center of scientific activity which is spontaneous in the members of its instructing corps -- activity prompted by a divine thirst for increasing our knowledge.

"I have urged upon the faculties and upon the trustees with all the earnestness of which I am capable that in the selection of young men for the position of instructor, that is, the lowest grade of our faculty positions, only those young men should be selected who have it in them to be good teachers, capable instructors and at the same time who have had the proper training and have within themselves the ambition to become investigators, research men, productive scholars, in the various lines in which they are at work.

"There is no doubt that if this plan is adhered to closely, systematically, continuously, for a generation, the University of Illinois, if the State equips it properly with libraries and apparatus, will become one of the great centers of learning in the world, a credit to the people of the commonwealth, a source of

1 The Technograph, February, 1934, page 4.

untold advantage to the culture and industry of this great state."[1]

The period following 1920 brought about an increase in the faculty of the College of Engineering in both the instructional and experimental fields, for there was at that time a substantial increase in student enrollment and interest in systematic research. In particular there was a noticeable improvement in the standards of preparation of the younger members of the staff that has continued to the present day -- an improvement that was due in large measure to the provisions made for graduate work.

The College has continued to follow the policy, established so long ago, of choosing experts for particular fields with years of experience as a background, who are enabled thereby to present to their students not only the theoretical point of view of the subjects under consideration but also the professional applications of the materials in the light of their practice in the industrial world. Many of these men have attained a national reputation for the work they have done and have become highly respected by the members of learned groups for their outstanding technical ability and accomplishments. The presence of a few such top-ranking men is a wonderful asset to an institution of learning, and in this experience the College of Engineering has been unusually fortunate.

The number of persons of various grades or ranks serving on the College Faculty from 1870 to 1940, is given in the following table:

TABLE XVI NUMBER OF PERSONS ON THE TEACHING AND EXPERIMENTAL STAFF OF THE COLLEGE OF ENGINEERING, 1870-1940

Year	Prof.	Assoc. Prof.	Asst. Prof.	Associate[2]	Instr. and Res. Asst.	Asst.[3]	Total
1870-71	1						1
1874-75	2		1		2	3	8
1879-80	2		1		3		6
1884-85	4		2		2		8
1889-90	3		1		3	3	10
1894-95	5		3		8	9	25
1899-00	6	2	8		6	4	26
1904-05	8	0	9		23	3	43
1909-10	10	3	19	9	38	19	98

1 "Sixteen Years at the University of Illinois", page 150.
2 The grade of Associate was created by the Board of Trustees in 1907.
3 Includes Research Graduate Assistants.

Year	Prof.	Assoc. Prof.	Asst. Prof.	Associate	Instr. and Res. Asst.	Asst.	Total
1914-15	19	1	19	15	47	30	131
1919-20	28	4	22	18	26	32	130
1924-25	30	8	35	12	59	25	169
1929-30	39	11	22	27	44	57	200
1934-35	40	12	25	29	16	35	157
1939-40	45	17	33	24	44	49	212

Contrasted with a faculty of one man in 1870, eight in 1885, and 26 in 1900, the faculty of the College of Engineering in 1940 numbered 212 persons of all ranks including 95 men of professorial rank, 68 associates and instructors, and 49 assistants.

B. COLLEGE POLICIES AND OBJECTIVES

General - The College educational program was instituted or oriented on a high-level basis in the pattern formulated by Professor Robinson when he took over responsible direction of much of the work of the College in 1870 and the years immediately following as previously stated. Furthermore, as mentioned earlier, Professor Robinson was soon to become associated with and assisted by other instructors who were also impelled by lofty ideals for the building up of a great educational institution founded upon principles of superior performance. Through the years since then, these same high purposes have continued to guide and to motivate the directing powers in formulating any plans or proposals for instructional or experimental work the College might undertake.

This general objective of the College of Engineering is stated in the 1891-92 issue of the Catalogue[1] as follows:

"The purpose of the College of Engineering is thoroughly to educate and prepare engineers and architects for their future professional courses. Its aim is therefore twofold -- general and technical. A considerable portion of the courses of study must be devoted to general and literary work, since a graduate is now expected to arrange his ideas in clear order, and to write and speak effectively whenever it becomes necessary. Professional success frequently depends upon this power far more than is commonly supposed. Moreover there is an ever-increasing fund of general and scientific knowledge with which any educated man is expected to be conversant, if he desires to retain the esteem of his associates and clients. A large and most valuable portion of the knowledge is still locked up in foreign languages, and these must be acquired by patient study and practice. Scarcely a single science is not at some time useful to the professional man, and some of them, like mathematics or physics, are so intimately interwoven with the different

1 Page 40

[illegible]

branches of technical knowledge, as to be practically indispensable, and so require a more thorough mastery than is necessary to the literary man. It might appear that this general training would alone be sufficient to absorb the entire attention of the student during his whole course, but not less than one-half of his time must be given to purely technical training, and the acquiring of a professional capital, or stock of information and knowledge of details, which is almost limitless in its demand and possibilities. The methods employed for embodying new ideas in drawings, intelligible to other professional men and to mechanics must likewise be acquired."

"A knowledge of the latest results of scientific experiments is likewise essential, requiring wide reading by some one, either student or professor. Engineering knowledge must be fresh, to be valuable, since ideas and methods are quickly supplanted by improved ones, and become useless except as mile-stones of progress. Consequently, the most valuable part of this professional knowledge can never be crystallized in textbooks, but must be drawn from the mental stores of the teacher."

The University Catalogue of 1904-05, the first to appear after the establishment of the Engineering Experiment Station in 1903, stated[1] anew in more detail the general aims of the College as follows:

"The purpose of the College is a threefold one:

1 To train and prepare men for the efficient practice of the different professions of engineering and that of architecture, as well as to become managers of great business and industrial enterprises. Both professional and cultural studies are prescribed, since a successful engineer must possess broad views and be able to write and speak correct and rigorous English in order to present his views clearly and effectively. Training in proper methods for solving engineering problems is of much greater importance than the collection of stores and data, however valuable. But the graduate must be an efficient worker at the beginning of his career in some specialty of his chosen profession.
2 To provide instruction for graduates and to supervise their studies in selected fields, thus meeting a demand for highly-specialized instruction and research.
3 To make original investigations and experiments in those lines of research which are of greatest interest and promise to the engineering and industrial enterprises of the citizens of this State."[2]

The 1908-09 issue of the Annual Register[3] contained the following statement outlining still further the purposes of the College:

"The purpose of the College is to train young men for the profession of engineering. In arranging its courses of study and practice, cultural subjects have not been neglected, but are interwoven with the strongly theoretical subjects which underlie and reinforce the more practical development of the several departments. The instruction in the classroom and the practice offered by the library, the drafting room, and the laboratory proceed hand in hand. Throughout his course the student works upon problems, and proceeds by methods which are similar to those which enter into the experience of the practicing engineer."

---

1 Page 93
2 In 1908 the statement was added: "and to distribute the knowledge gained from such research."
3 Page 96.

Explicitly defined in more modern terms, the general aims of the instructional programs of the College are designed so to train men for true citizenship and for such leadership and service that they may be able to utilize sound reasoning processes in visualizing, designing, constructing, and operating or administering any engineering project that they may be called upon to attend according to the following specifications prescribed by the Engineers' Council for Professional Development in a pamphlet entitled "Engineering as a Career".[1]

"The engineer first studies his problem to determine its nature and scope; then he breaks his problem down into its numerous small component parts, establishes the relationship between these parts, and determines the known and the unknown elements; he then acquaints himself with all available pertinent facts that have been established by experience, research, or experiment; then he solves the small component parts separately, and progressively fits them together to compose the answer to his original general problem. In reaching his conclusions, the engineer starts with known facts and established principles, and by logical reasoning and resourcefulness proceeds in an orderly step-by-step manner, avoiding the pitfalls of wishful thinking and the snares of purely personal or political considerations."

Authority for College Policy - Of course, the general educational policies of the College of Engineering have been synchronized with and governed in the main, by those instituted for the conduct of the University in general; and in so far as College action deals with general policies, such action must be approved by the University Senate or other University governing agency or body before it can become effective. In working out details of programs, schedules, or curricula, the College has, however, a certain amount of autonomy.

The Development and Determination of College Policy - The College faculty, the governing authority for the Engineering group, together with the Dean and Assistant or Associate Dean, and such committees as have been authorized by University or College regulations, have from time to time given much time to consideration, examination, and appraisal of such matters as curricula, courses, and other topics relating to the educational policy and material development of the College. Of the great number of subjects that have been considered along this line by the different groups, a few, but only a few, typical cases are discussed in the following pages.

1 Page 9.

Professional Engineering and Science Courses vs. the Humanities in the Curricula - While the general and specific objectives of the College have been pretty well defined throughout the years, the instructional program has been varied from time to time to correspond with changing conditions in industry. In the early days, engineering was largely an art, a craft, or a trade carried on generally by rule-of-thumb practice. There were comparatively few technological fields sufficiently developed to furnish instructional materials for the curricular programs. Sufficient time, then, could be allotted to the languages, humanities, and other liberal-arts subjects in addition to mathematics to form sound and well-balanced classroom schedules. Later, however, as the science of technology began to develop, its evolution came at such a pace and so varied in scope, and pattern as to outstrip even the advances made by the older political, social, and economic institutions, affording unlimited possibilities of achievement for the engineer as he came to assume more and more of the responsibilities of production . As the pressure to inject more of the technical subjects into the curricula increased, the tendencies were to substitute them for the so-called cultural or classical courses. This matter of the relative values and relationships of curricular studies has at times seemed almost bewildering and is discussed briefly in the next few paragraphs.

Language and Rhetoric Requirements - In the early days, much of the literature relating to the field of engineering was written in a foreign language, especially German and French, as previously mentioned, and training in these subjects became a part of the standard curricula. As time went on, however, the output of technical literature in America began to increase, and as production improved, the literary materials turned out in this country became more valuable to us than those abroad. They became so voluminous, too, that the average man in practice could scarcely hope to review all the publications in a particular field. Under pressure of assessing valuations of potential materials for the curricula, various committees undertook at several times, studies of the matter of foreign language as requirements for graduation, with the final result that language requirements were

eliminated from most of the curricula. All groups reviewing the curricular content have been consistent in their opinion, however, that rhetoric should remain as a required subject; and in all curricula it is scheduled as a three-hour subject through out a one-year period.

Non-Technical Electives - Various committees and other groups have also studied the matter of non-technical electives -- those non-technical subjects that are sympathetic with the basic instructional program, but which are not included in the prescribed schedule, and which are available for election by the student at his own volition. The space allotted to such topics has sometimes increased under the attempt to liberalize the curricula ~~and has again declined under the attempt to liberalize the curricula~~ and has again declined under the impelling demands for greater attention to technological training to serve in new and developing fields. Within the last few years, it has even disappeared entirely from some schedules and has decreased to six or eight hours at the most in others. A number of ways to solve the dilemma of conflicting interests have been proposed, one or two of which are treated briefly in the following pages.

The Four-and Five-Year Curricula - About 1915, there began the realization among engineering college administrators that the four-year curricula then current did not provide sufficient opportunity for the departments to include all the subjects -- technical, scientific, economic, literary, and historical -- that properly belonged in a well-balanced instructional program designed to turn out graduates as specialists equipped to cope with complex conditions. After some years of serious deliberation, the several schools especially interested, followed generally one of two major policies as a way out of the difficulty. One of these was the five-year plan for undergraduate study either on the basis of a straight five-year curriculum or on an arrangement of two years of preliminary study in liberal arts as a prerequisite for registration in a three-year curriculum in engineering -- one or two schools even requiring such preliminary study as prerequisite for their four-year curriculum in engineering. The other policy was to adopt a four-year curriculum for undergraduate study followed by at least one

additional year of graduate study. The University of Illinois chose in general the second method and has maintained it to date.

The College has defended this action on the ground that even a five-year curriculum is too long for the rank and file of students -- that many of them would drop out long before the day of graduation. It has felt that it would serve the purpose better to have the majority go four years and then graduate and go into practice, and let those who were qualified and so inclined, spend one or more years of intensive graduate study in rather highly specialized fields in preparation for such positions as involve research, design, or scientific analysis.

Graduate Study in Engineering - Because the demand from both students and industry for extensive training in an ever-increasing number of technical subjects as well as for a more intensive preparation in the fundamental science courses, mathematics, and the humanities that are so essential to any well-organized program, increased the number of desirable courses beyond the range of possibilities of the four-year curriculum, as previously stated, and because the growing emphasis placed upon engineering and scientific research served to focus greater attention on graduate study, the departments were led to offer graduate work of one or more years study as a means for meeting the situation. Many students have taken advantage of the opportunities thus presented on the post-graduate level for attaining greater proficiency in some professional field, continuing in programs of advanced study in their chosen lines of specialization beyond the senior year to earn the master's degree and to a relatively increasing extent, the doctor's degree. The academic atmosphere offers in the domains of both pure and applied science a freedom for investigational effort that is in large measure unfettered and unbiased by considerations of economic rewards or of utilitarianism and necessity that to a certain extent influence the motives in many an industrial enterprise in exploring the fundamentals underlying science and industry. Graduate study is carried on a higher level of performance than that maintained by the average undergraduate, and demands higher scholastic attainments, greater mental initiative, more independent thought and investigation, and more concentration

than that displayed by younger students.

Engineering Research - Engineering Research is a systematic or organized effort to observe or establish new principles and laws of truth and the relationships that exist between them, to study meticulously and scientifically the behavior or performance of engineering materials and products, and to analyze and examine precisely and intelligently the processes of production and operation in order to broaden or extend the foundational basis upon which our industry stands. The College of Engineering has generally felt that research should go hand in hand with engineering instruction, not only that certain material advantages would thereby accrue to industry, but also that such a policy, properly followed, would serve to enlarge the basis of education and improve the instruction, benefiting the instructor himself as well as his students enrolled in both undergraduate and graduate courses. The experimental work thus carried on here in correlation with the instructional program is both pure and applied, the pure or academic efforts being devoted largely to the development of new facts or knowlege and relationships, and applied or industrial research to the utilization of such information to the development of new industries or to the improvement of those already established. This subject, a topic of frequent discussion by College committees,is considered further in connection with the materials in Chapter XXV describing the Engineering Experiment Station.

Dual Curricula - Beginning in 1938-39, the College of Engineering adopted the principles of the dual curricula whereby undergraduate students of superior ability were allowed to make deviations from the standard curricula and engage in special-work programs suiting the individual needs and tastes. A special schedule of subjects was made for each particular student to suit his peculiar case --only a comparatively few being granted this privilege, of course, on account of the difficulties involved in administration. These special programs included all the the fundamental subjects of the regular curricula of the respective departments, the variations being made only in the applied courses looking to particular training in specialized fields. This innovation was practically discontinued during the

war period due to the rigidity of the schedules of the enlisted men and of the limited registration of other men, but it did serve the useful purpose of stimulating registrants to greater effort, for students regarded it a signal honor to be accorded such consideration.

C. STUDY OF EDUCATIONAL REPORTS

Study of the Mann Report - The extensive report[1] on the status and objectives of engineering education in the United States prepared by Dr. Charles R. Mann, a professor of Physics in the University of Chicago, and published by him in 1918 as a representative of the Carnegie Foundation for the Advancement of Teaching, was made a topic of special study by the College of Engineering during the administration of Dean Charles Russ Richards.

1 The initial steps in this original investigation were taken in 1907 when the Society for the Promotion of Engineering Education invited the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Chemical Society to unite with it in appointing delegates to a "Joint Committee on Engineering Education to examine into all branches of engineering education including engineering research, graduate professional courses, undergraduate engineering instruction, and the proper relations of engineering schools to secondary industrial schools, or foremen's schools, and to formulate a report or reports upon the appropriate scope of engineering education and the degree of cooperation and unity that may be advantageously arranged between the various engineering schools." - The Mann Report, page IX

While Dr. Mann carried on the investigation and formulated the report, the Committee duly appointed by the several national organizations cooperating, frequently conferred with him during the progress of his studies to satisfy themselves regarding the course of the investigation and the plans adopted to carry on the undertaking.

The point of view from which the study was undertaken was the following:Fifty years ago, when the engineering schools of the United States were inaugurated, they began their work upon a definite teaching plan and one that had pedagogic consistency. The course was four years. The first two were spent in the fundamental sciences—chemistry, physics, mathematics, and mechanics; the last two mainly in the applications of these sciences to theoretical and practical problems.

"In the half century that has passed, this course of study has been overlaid with a great number of special studies intended to enable the student to deal with the constantly-growing applications of science to the industries. While the original teaching plan remains as the basis of the four-year engineering curriculum, the courses given in most schools have been greatly modified in the effort to teach special subjects. As a result, the load upon the student has become continually heavier and bears unequally in different places and in different parts of the course. In addition, there is a wide-spread feeling that under this pressure the great body of students fail to gain, on the one hand, a satisfactory grounding in the fundamental sciences; and on the other hand, do not fulfill the expectations of engineers and manufacturers in dealing with the practical problems with which they are confronted on leaving the engineering schools.

"It is out of this situation that the Committee of the Engineering Societies began its study, whose purpose is not so much to record the details of engineering teaching in the various schools as to examine the fundamental questions of the

Dean Richards believed, and many of the faculty concurred in the opinion, that such a review of educational practices would serve the double purpose of informing the group on matters relating to technical training and of affording an opportunity of reexamining and analyzing our own educational processes with the idea of making improvements and of stimulating greater efforts in classroom performance.

The local studies were carried on largely by committee reports, each one representing some phase of the original presentation; and by emphasizing the importance of keeping abreast of the times and the necessity of meeting the peculiar demands made by an ever-expanding and growing industry, the study did serve the purpose of causing the faculty to re-assess the entire structure and objective of engineering education and to approach the problem of improving their teaching and laboratory processes.

Study of the Wickenden Report - During the administration of Dean Milo S. Ketchum a series of reports on the status of engineering education in the United States and Europe, published during 1923-29 by the Board of Investigation and Coordination of the Society for Promotion of Engineering Education, William E. Wickenden, now President of Case School of Applied Science, being the Director of Investigation, was made the basis for a lengthy study of educational practices. This report, often referred to as the Wickenden Report, was issued in final form in 1930 -- the culmination of a comprehensive study begun in 1923 that looked to the improvement of engineering education, and that was summarized briefly in the following statement:[1]

---

right methods of teaching and of the preparation of young men for the engineering profession: in other words, to question anew the pedagogic solution of fifty years ago, to examine the curriculum of today and the methods of teaching now employed, and to suggest in the light of fifty years of experience the pedagogic basis of the course of study intended to prepare young men for the work demanded of the engineer of today." - Preface to Ibid. by Henry S.Pritchett, pages V and VI.

1 Report of the Investigation of Engineering Education, 1923-29,Foreword,page III.

"The assemblage of facts and data pertaining to the field of engineering education affords a definite idea of what is now being done. It presents to those who are familiar only with the particular institutions or fields of work in which they are engaged a general view; the present study integrates the whole field in a way to afford insight into needed developments as well as appraisal of the present situation. It presents the condition within the schools and much information regarding the engineering student, the alumnus, the attitude of practising engineers, teachers and industrial managers. It presents a basis for consideration of problems within the engineering school, both undergraduate and graduate, and it shows in illuminating perspective its relation to other fields - the preparatory school, the training courses for graduates in industry, the technical institute, the engineering profession, and the economic phases of modern life."

The meticulous review of this lengthy report served, like the previously-mentioned one, to cause the faculty to look critically into its curricular outlines, to inquire analytically into its methods of teaching, and to impress upon the members the seriousness of the responsibilities placed upon them of turning out men competent to carry on the high standards of performance maintained by the engineering profession.

D. PROFESSIONAL CONTACTS WITH INDUSTRY

Faculty Contacts with Industry - The administrative heads of the College of Engineering have always recognized the value of the experience to be gained by associations with engineering industry. This is evidenced by the fact that members of the teaching staff, especially the younger ones, are urged to secure industrial employment during the summer months as a means of providing a better foundation for their classroom instruction. This is shown, also, by the provisions of sabbatical or other leave which enables faculty members to absent themselves from their University duties for relatively short periods of time in order to study or to engage in engineering practice along their particular lines of interest. As another means of contact with industry, the members of certain staffs or departments have on frequent occasions, been hosts to engineering conventions, committee meetings, short courses and conferences, or other groups assembled from industrial enterprises. The value of contacts made through cooperative research and through active connection with professional and scientific societies is discussed at some length under other headings in this publication.

Visits of Engineering Societies - One of the events of great interest was the

[illegible]

visit to the University on November 11, 1898, of 164 members of the Western Society of Engineers, among whom were many of the more prominent engineers of the Middle West. They arrived on a special train at one o'clock and were given a luncheon in the Physics Laboratory by the wives of the engineering faculty. After that they inspected the University buildings and grounds, and finally attended an assembly of the students and faculty of the College at which several of the visitors made addresses. They expressed themselves greatly surprised at the extent and variety of the buildings and equipment of the College; and their presence and speeches enthused and inspired the students, and greatly cheered the instructional staff. The effects of the visit were distinctly felt when students attempted to find positions during summer vacations or after graduation; and the University, and particularly the College, materially profited through this visit more than once in its campaign before the Legislature for appropriations. On May 11, 1907, the same Society paid a second visit to the College of Engineering with similar results.

On May 12, 1899, about 200 members of the Railway Club of St. Louis spent the best part of the day visiting the College of Engineering. The Club devoted 39 pages of its Proceedings to an account of the visit.

Due to the many professional-society and engineering-committee meetings that came to be held and are still being held on the campus, to the many personal and professional visits made by individuals from time to time, and to the long list of publications that have gone forth describing the University, its work in progress and its accomplishments, such mass inspections gradually declined and now no longer seem necessary as a part of the program of keeping those especially interested, abreast of our College development. Such groups would always be welcome, of course, but the many points of contact that have been established between the College and industry and professional service have provided even stronger and more lasting relationships than the earlier method could supply.

<u>Student Contacts with Industry</u> - While the College of Engineering has never advocated that a period of apprenticeship corresponding to that of internship in

medicine should be established as prerequisite for independent practice, the staff has always felt very strongly that a certain amount of contact with industry would be beneficial to the student while pursuing his college courses in giving him a better realization of the applications of his classroom work to methods in practice and in aiding him in securing placement after graduation. It was felt, however, that in the main, a sufficient amount of such experience could be gained by employment during the summer months with some responsible engineering or industrial organization to meet the ordinary needs. To assist in securing such experience, the College has for a number of years maintained a committee devoted in part, at least, to placing students in summer positions. This service has the additional advantage of providing a closer relationship between the University and industrial firms.

The College has never given serious attention, however, to the establishment of cooperative training here such as the Cincinnati, Pittsburgh, and other plans provide in which students spend part time in classroom study on the College campus and part-time in work in industry -- a system designed to allow students to apply day by day in practice what they learn in theory and thereby to give them a better grasp of the purposes and applications of educational training while learning the methods of industrial and commercial practice. The advantages of such arrangement are obvious where schools are located near large industrial centers where students can commute without serious dislocation to normal life. Here, however, where the University is so remotely situated from urban centers, the College has not seriously considered this type of educational instruction.

E. THE ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

Organization and Purpose - In order to provide a single accrediting agency as a substitute for the uncoordinated groups that had attempted to influence the trend of engineering education in the past, the Engineers' Council for Professional Development was authorized in October, 1932, by the joint action of the following seven national engineering societies: The American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of

Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Chemical Engineers, the Society for the Promotion of Engineering Education, and the National Council of State Boards of Engineering Examiners. The organization, consisting of three representatives from each of the seven participating bodies, had for its purpose "the enhancement of the status of the engineer. To this end, it aims to coordinate and promote efforts and aspirations directed towards the higher professional standards of education and practice, greater solidarity of the profession, and greater effectiveness in dealing with technical, social, and economic problems. Its immediate object is the development of a system whereby the progress of the young engineer toward professional standing can be recognized by the public, by the profession, and by the man himself through the development of technical and other qualifications which will enable him to meet minimum professional standards."[1]

One of the first studies undertaken by this group, the E.C.P.D., as it is generally known, was to formulate a plan for rating or accrediting any or all of the engineering schools and colleges in the United States that desired to have their educational programs reviewed. Most of the engineering institutions of the country were anxious to accept the services of this body -- the first one ever authorized and organized by the profession itself and one thoroughly competent to undertake such an assignment.

"E.C.P.D. is merely authorized by its constituent organizations to publish a list of accredited colleges for use by those agencies which require such a list. It has no authority to impose any restrictions or standardizations upon engineering colleges, nor does it desire to do so. On the contrary, it aims to preserve the independence of action of individual institutions and to promote the general advancement of engineering education thereby."[2]

<u>Basis Adopted by the E.C.P.D. for Accrediting Engineering Colleges</u> - The following statements formulated by the E.C.P.D. and approved by the seven major societies represent the basis for accrediting the individual curricula that were presented for examination:

1 First Annual Report of the E.C.P.D., October, 1933, page 1.
2 Fourth Annual Report of E.C.P.D., October, 1936, page 15.

I. Purpose of accrediting shall be to identify those institutions which offer professional curricula in Engineering worthy of recognition as such.

II. Accrediting shall apply only to those curricula which lead to degrees.

III. Both undergraduate and graduate curricula shall be accredited.

IV. Curricula in each institution shall be accredited individually. For this purpose, the E.C.P.D. will recognize the six major curricula: Chemical, Civil, Electrical, Mechanical, Metallurgical, and Mining Engineering -- represented in its own organization, and such other curricula as are warranted by the educational and industrial conditions pertaining to them.

V. Curricula shall be accredited on the basis of both qualitative and quantitative criteria.

VI. Qualitative criteria shall be evaluated through visits of inspection by a committee or committees of qualified individuals representing the E.C.P.D. The visits of inspection either as to entire institutions or as to specific curricula may be waived at the discretion of the Council.

VII. Quantitative criteria shall be evaluated through data secured from catalogs and other publications, and from questionnaires.

VIII. Qualitative criteria shall include the following:

(1) Qualifications, experience, intellectual interests, attainments, and professional productivity of members of the faculty.

(2) Standards and quality of instruction:

(a) In the Engineering Departments
(b) In the Scientific and other cooperating departments in which Engineering students receive instruction.

(3) Scholastic work of students.

(4) Records of graduates both in graduate study and in practice.

(5) Attitude and policy of administration toward its engineering division and toward teaching, research, and scholarly production.

IX. Quantitative criteria shall include the following:

(1) Auspices, control, and organization of the institution and of the engineering division.

(2) Curricula offered and degrees conferred.

(3) Age of the institution and of the individual curricula.

(4) Basis of and requirements for admission of students.

(5) Number enrolled

(a) in the engineering college or division as a whole.
(b) in the individual curricula

(6) Graduation requirements.

(7) Teaching staff and teaching loads.

(8) Physical facilities. The educational plant devoted to engineering education.

(9) Finances; investments, expenditures, sources of income.

Investigations of Engineering Curricula at Illinois by the E.C.P.D. - At the invitation of the University of Illinois, representatives of the E.C.P.D. visited the College of Engineering here on April 6, 1937, for the purpose of investigating the different curricula in the College with the idea of approving or disapproving them. In preparation for the inspection, each department had arranged in advance a collection of textbooks, notes, instructions, samples of students' work, assignments, etc., for every course offered, so as to expedite the examination. Mr. Emerson P. Poste, Consulting Ceramic Engineer of Chattanooga, Tennessee, was examiner for Ceramic Engineering; Professor Ralph B. Wiley, Head of the School of Civil Engineering at Purdue University, for Civil and Railway Civil Engineering; Professor A. D. Moore of the University of Michigan, for Electrical and Railway Electrical Engineering and Physics; Doctor Donald B. Prentice, President of Rose Polytechnic Institute, for Mechanical and Railway Mechanical Engineering; Professor D. J. Demorest of Ohio State University, for Mining Engineering and Metallurgical Engineering; and Dean P. H. Daggett of Rutgers University for General Engineering.

In addition to examinations of classroom facilities, the inspectors spent some time visiting the laboratories looking over the equipment used for instructional purposes. As a result of the investigation, the curricula in Architectural Engineering, Ceramic Engineering (technical option), Chemical Engineering, Civil Engineering, Electrical Engineering, General Engineering, Mechanical Engineering, Mining and Metallurgical Engineering, and Railway Engineering were approved during 1937-38. The curriculum in Engineering Physics was not accredited, following the general decision that no curricula in Engineering Physics were to be accredited.

F. COLLEGE FINANCE

College of Engineering Finance, 1868-1913 - One of the things that the College of Engineering learned in its early history was that instruction in engineering especially in its laboratory classes, was more expensive than that in literature and arts courses because of the relatively high first cost of equipment and the heavy expense involved in maintenance and operation in proportion to the number of students trained. This fact was sorely emphasized during the administration of President Draper, when on the night of June 9, 1900, the building containing the wood shop, the materials and hydraulic laboratories and the gymnasium was completely destroyed by fire; and for the next academic year it was necessary to omit a considerable part of the instruction in the wood shop and the laboratories. The loss was fixed at $76,000, and the Legislature at the ensuing session made an appropriation to cover the loss, but gave only $10,000 for maintenance and extension of engineering equipment. The fire seriously handicapped the work of the College, as the money spent to repair the fire loss could have been employed to improve the other facilities; and therefore the fire postponed for a biennium much-needed improvements and enlargements in equipment and buildings.

The University authorities were not lacking in interest in the College of Engineering, however, and on June 30, 1902, the Board of Trustees appointed a committee of its members to investigate and report upon the needs of the College. This committee reported on December 9, 1902, as follows: "Your committee after a careful study of the methods of instruction and the equipment of the leading technical schools in this country is of the opinion that the College of Engineering ought to have additional buildings, a large increase in equipment, some increase in the instructional force, and some changes in courses of study and methods of instruction." The committee presented a list of four needed buildings to cost $233,000, and also six items of equipment to cost $298,250. However, in preparing the budget of askings to be presented to the Legislature in 1903, the Board voted to ask for $637,720 per annum, but included only $10,000 for engineering equipment -- that is, other University interests were given precedence over

Engineering. At the same session, nevertheless, the Board voted that $300,000 be asked in a separate bill for the enlargement of the College of Engineering. The President of the University requested that he be not charged with the presentation of this bill, but that the members of the engineering faculty be allowed to advocate its passage. The faculty organized for the campaign by appointing Professor L. P. Breckenridge to present the matter to the manufacturing and mining interests of the State, Professor A. N. Talbot to the alumni, and Professor I.O. Baker to the students, These and other members of the engineering faculty entered upon an active campaign of publicity, wrote letters, made addresses, secured articles in the newspapers, and appeared before legislative committees; and in the end the Legislature voted $150,000 for the College of Engineering. President Draper in a written report to the Board of Trustees said: "The appropriation was secured not by the efforts of the general authorities of the University alone, but by the very vigorous work of the engineering faculty and the students and the alumni of the College, supplemented also by the very cordial cooperation of the organizations and business men engaged in the building and constructive business of the State."[1]

This appropriation marked a new epoch in the history of the College of Engineering. This sum not only met some of the pressing needs, but set a new standard for legislative askings and appropriations. In 1905, the Trustees asked for and received $150,000 as a special appropriation for maintenance and extension of engineering equipment; a like appropriation was received in 1907; and in 1909, the sum of $160,000 was obtained for the purpose. The total expenditures of the College and Station for 1908-09 were $200,000; for 1909-10, $235,000; for 1910-11, $279,850; and for 1911-12, $231,000. After 1912, the total disbursements by the College and Station are given in the published annual reports of the Comptroller of the University. Figures taken from these reports are included in the next section.

<u>College of Engineering Expenditures, 1913-1944</u> - The operating expenditures of the College of Engineering for each year for the thirty-two-year period from

1 Report of the Board of Trustees, December 8, 1903, page 236.

1912-13 to 1943-44 are given in the following table. These figures, of course, do not include the amounts appropriated for new buildings, which were given in a previous chapter.

TABLE XVII - COLLEGE OF ENGINEERING OPERATING EXPENDITURES, 1913-1944[1]

Year	College	Station	Coal Mines Investigations	Miners' and Mechanics' Institute	Cadet Aviation School	Total
1912-13	$202 858	35 606				238 464
1913-14	250 716	43 800				294 516
1914-15	253 989	37 855				291 844
1915-16	273 525	39 673	$2 897	$1 428		317 523
1916-17	301 651	43 171	4 457		$1 061	350 340
1917-18	264 202	36 272	5 277			305 751
1918-19	281 800	47 560	4 411			333 771
1919-20	309 962	46 504	5 149			361 615
1920-21	288 686	26 676	2 200			317 562
1921-22	486 576	70 977	4 938			544 491
1922-23	505 439	72 706	6 185			584 330
1923-24	512 557	81 739	2 050			596 346
1924-25	530 761	96 128	5 323			632 212
1925-26	522 081	86 732	5 873			614 686
1926-27	552 016	88 779	4 745			645 540
1927-28	548 258	87 794	4 929			640 981
1928-29	561 256	92 503	4 610			658 369
1929-30	574 801	108 482	4 806			688 089
1930-31	586 927	235 995	4 272			827 194
1931-32	518 647	224 385	5 637			748 669
1932-33	471 917	159 138	4 035			635 090
1933-34	424 622	141 266	3 787			569 675
1934-35	426 414	170 784	3 806			601 004
1935-36	476 449	162 580	3 910			642 939
1936-37	478 000	174 501	4 033			656 534
1937-38	524 486	209 327				733 813
1938-39	550 613	224 075				774 688
1939-40	569 414	249 625				819 039
1940-41	567 573	245 533				813 106
1941-42	541 970	243 059				785 029
1942-43	553 749	220 451				774 200
1943-44	549 348	227 066				776 414

G. FACULTY MEETING ROOMS

General - When the College of Engineering moved into Engineering Hall in in 1894, the faculty meetings were held in Room 302 of that building, designated as the Faculty Parlors. After Dean Goss took over this room for his office in 1907, the faculty held its assemblies in 221 Engineering Hall -- the Physics Lecture room. After this room was remodeled in 1931 for use as the second floor

1 Figures are taken from the published reports of the Comptroller of the University of Illinois. The totals do not include appropriations for new buildings.

of the Engineering Library, the faculty meetings were held for a year or so in 319 Engineering Hall and after that in Room 100 - the large assembly and lecture room -- in the Physics Building.

H. MUSEUMS AND COLLECTIONS

Museum of Engineering and Architecture - The following statement appeared on page 26 of the Catalogue and Circular of 1885-86:

"A large room in University Hall[1] was devoted to the gathering of a museum of practical art, the materials for which are constantly accumulating in the various schools of science. It contains full lines of illustrations of the work of the shop: models made at the University or purchased abroad; drawings in all departments; patent-office models, etc.; samples of building materials, natural and artificial; with whatever may be secured that will teach or illustrate in the most important phase of University work; the elegant exhibit made by the University at the Centennial and Cotton Exposition at New Orleans found a permanent abode in this apartment.

"A notable feature of this collection is the gift of Henry Gay, Architect of Chicago. It consists of a model in plaster, and a complete set of drawings of a competitive design for a monument to be erected in Rome, commemorative of Victor Emmanual, first King of Italy. The monument was to be of white marble, an elaborate gothic structure, beautifully ornamented, and three hundred feet high. Its estimated cost was to have been seven and a quarter million of francs. The design was placed by the art commission second on the list of 289 competitors; but both the first and second were set aside for political reasons. Mr. Gay's generous gift occupies the place of honor in the Museum of Engineering and Architecture."

Efforts were made at one time or another in later years, to bring together into one common place and preserve all of the museum materials of the College in a continuation of this early custom. The dominating difficulty in every instance was, of course, the lack of available and suitable space; for ever since the beginning, the College has been perplexed to find sufficient room for its class and laboratory requirements. As a result, each department has sought to maintain such limited amounts of museum materials as its restricted assignment of space has permitted.

I. GENERAL COLLEGE ACTIVITIES

Illinois-Indiana Section of SPEE - On April 6, 1935, the newly-founded Illinois-Indiana Section of the Society for the Promotion of Engineering Education held a meeting at Purdue University -- the faculties of Illinois, Purdue, Armour, Rose Polytechnic Institute, Northwestern, Lewis Institute being represented. The

1 On top floor of the west wing.

next meeting was held on April 18, 1936, in the Lawson Y.M.C.A. Building in Chicago -- the schools in Chicago being hosts. The third meeting was held in Urbana on April 3, 1937 -- Professor Hoelscher of the Department of General Engineering Drawing at the University of Illinois being President that year. Similar meetings during later years were held at Rose Polytechnic Institute and Notre Dame. The Illinois members of the Section have been active in these meetings in the presentation of papers, reports, and discussion, on matters relating to problems dealing with engineering education.

<u>All Engineering College Lectures</u> - In a letter addressed to the Board of Trustees under date of December 8, 1891, Dean N. C. Ricker made the following request:

"The faculty of the College of Engineering respectfully request that the Board of Trustees appropriate the sum of $500 to be expended in obtaining technical lectures from eminent specialists in engineering and architecture, on topics related to the course of study in the College, but in addition to the regular instruction imparted by the professor in charge. It appears probable that the cost of a single lecture and expenses of lecturer would average about $50 each, unless several lectures from each person are delivered during his stay at the University. The effect of these lectures will be excellent; they will further enable advanced students to make valuable professional acquaintances, and we believe that no better means of advertising the University in technical and professional circles can be found."[1]

The request was granted, and these early lectures were held in the Chapel in University Hall. The first of the series was given in March, 1892, by W. L. B. Jenny of Chicago, on the subject "Tall Buildings on Compressible Soils." The second was given in the same month by David L. Barnes, consulting mechanical engineer of Chicago, on the subject "Locomotive Construction." The third speaker was J. A. L. Waddell, consulting engineer of Kansas City who on April 7, 1892, gave two lectures on the subject of bridges, the afternoon talk being on the "Design of Construction of Bridges and Roofs," and the evening talk on "Details of Construction of Bridges and Roof Trusses".

Thus there was begun here a custom that has continued to the present time, of inviting noted men to the campus to lecture in their particular fields of engineering practice as a means of bringing students and faculty into contact with men engaged in professional service, thereby inspiring and refreshing both groups and

1 Report of the University of Illinois, 1892, page 171.

supplying specific information on topics relating to engineering practice, as well as educating the visitors regarding the University's attainments and possibilities.

Among the list of lecturers coming later was Charles P. Steinmetz, Chief Consulting Engineer of the General Electric Company and Lecturer in Union College, who made several visits to the campus for the purpose of addressing the College. One of his lectures was given in the afternoon of November 27, 1907, on the subject of "Alternating Current Railway Motors." Others were given during 1911-13; one of the subjects being "Unexplored Fields of Engineering" and still another (on March 7, 1911) "Electrical Energy." Dr. Robert A. Millikan of California Institute of Technology, gave three lectures in the University Auditorium during December, 1927. One of these, on December 8, was entitled "Evolution and Religion."

Karl Von Terzaghi, noted professor of Vienna's Technische Hoch Schule, and later of Harvard University and Massachusetts Institute of Technology and the world's foremost authority on soil mechanics, presented a series of three lectures on March 30 and 31, and April 1, 1936 -- the first being concerned with "Theory and Practice in Soils Mechanics"; the second with "Mohr's Diagram and the Stress Conditions for Failure of Saturated, Porous Materials"; and the third, with "Arching in Soils - a Neglected Aspect of Earth Pressure Phenomena."

On May 13, 14, and 15, 1937, under the auspices of the Department of Ceramic Engineering and the University Lecture Committee of the College, Dr. Woldemar Weyl, Head of the Glass Division of the Kaiser Wilhelm Institute für Silikatforschung, Berlin, Germany, gave four lectures. The first was entitled "The Constitution of Glass", the second, "The Absorption Spectra of Solutions and Glasses; a Tool for Investigating Intermolecular Forces and Constitution Problems", the third, "Colored Glasses", and the fourth, "The Interaction between Gases and Molten Silicates."

Four University lectures were given in 215 Electrical Engineering Laboratory by Dr. Arthur Casagrande of the Harvard Graduate School on April 6, 7, and 8, 1938, on the subject of soil mechanics. The first of these was entitled "The Principles

of Soil Mechanics", the second, "The New German Highways", the third, "Recent Developments in Settlement Analysis", and the fourth, "Recent Developments in Earth Dam Design."

A few of the other lectures were Eugene Grace of the American Telegraph and Telephone Company, Samuel Insull of the Commonwealth Edison Company, and Edward J. Mehren, Vice-president of the McGraw Hill Publishing Company -- all aside from and in addition to the long lists of speakers that have been drawn to the campus by student scientific and other societies connected with the College of Engineering.

J. THE ENGINEERING EXPERIMENT STATION

General - The Engineering Experiment Station established in 1903, has performed such an important service in connection with the College of Engineering that an entire chapter[1] has been devoted to a presentation of materials relating to its organization, operation, and accomplishments. It may be stated here, though, as President James has put it in his "Sixteen Years at the University of Illinois"[2], that "probably none of the activities of the College of Engineering is of greater importance or has received more favorable and wide-spread attention than the Engineering Experiment Station." The achievements of its distinguished scientists and scholars have not only served to stimulate engineering education, but also to develop a vast body of original information relating to engineering principles, engineering problems, and engineering practice. It may be further stated, therefore, without reservation that the work of the Station and its accomplishments in the fields of science and technology, have been the means of extending the circle of influence of the College and the University to practically every part of the industrial world, thereby contributing a substantial share towards establishing the high place and prestige that these organizations now enjoy among the great institutions of higher learning in this land.

1 XXV
2 Page 208

CHAPTER V

COLLEGE OF ENGINEERING ADMINISTRATION AND ADMINISTRATORS

Provisions for College Administration - The first mention of dividing the University into the four colleges, Agriculture, Engineering, Literature and Science, and Natural Science was, as previously stated, in the 1870-71 issue of the Catalogue and Circular, as it was then called. The faculties of the four colleges were not organized, however, until 1878,[1] ten years after the University opened, although the work of the College of Engineering may be said to date from January, 1870, when Stillman Williams Robinson became Professor of Mechanical Engineering.

The University statutes as adopted in December, 1908,[2] provided that:

> "The faculty of each college or school may exercise legislative functions touching any matter appertaining exclusively to the internal work of that College and the progress of students therein. It shall not, however, have authority to take away from any student any University privilege, nor shall it do anything trenching upon the executive duties of the dean. It must be understood that the college organization is only for convenience within University circles, and that no college shall take action not well supported by rule or usage for which the general officers of the University may be called upon to answer. All matters of general policy, or matters involving the interests of outside parties, must be determined by general University authority."

These stipulations or similar ones have continued to be the guiding elements in the determination of college policy and direction to the present day, although some modifications have been made in the details of administration from time to time as conditions have changed. For example, the statutes adopted in March, 1936, made provisions for some modifications according to the following statements:

> "The college shall be governed in its internal administration by its faculty. The faculty shall consist of the President, the dean and assistant dean of the college, and all professors, associate professors, assistant professors, associates, and instructors within the group it comprises, together with a representative of each such other department or group as may be entitled to representation by virtue of participation in the program of instruction in the college, and finally such other officers of the University as the President may assign thereto.

---

1 On February 15, 1878, the general University faculty recommended that the members of that body be divided into college groups and that Professor Stillman Williams Robinson serve as Dean of the Engineering group.

2 "Revision of University Statutes", December 28, 1908, in Report of the Board of Trustees.

"The college shall have jurisdiction in all educational matters, not involving questions of general university policy and not involving its relation to other colleges or schools, falling within the scope of its program, including the determination of its curricula, except that proposals which involve budgetary changes shall be submitted to the President acting with the advice of the Council. The college shall have the fullest measure of autonomy consistent with the maintenance of general university educational policy and correct academic and administrative relations with other divisions of the University.

. . . .

"There shall be an executive committee of two or more members, composed of or selected from the professors and associate professors in the college, elected annually by the faculty, to advise the dean in the administration of the college and to transact such business as may be delegated to it by the faculty. The dean shall be ex-officio a member and chairman of this committee."[1]

As the College of Engineering has operated under the present rules during the last several years, the selective membership of the executive committee as nominated and elected by the College faculty at the beginning of each school year has, for matters of convenience, consisted of the heads of the several departments within the College.

Each year, a number of standing committees have been appointed by the executive committee to carry on studies of policy and to administer the more or less routine matters of interest to the College group. Among these have been included those on college policy and development, dual curricula, employment and alumni records, graduate work, inspection trip, library, petitions, program, and review of student records. As occasion has required, a number of special committees have been chosen, in addition, to consider topics requiring exceptional or unusual attention.

As the chief administrative officers directing all-college affairs in engineering have been the dean and the assistant or associate dean, the remainder of this chapter is given to a discussion of the duties of these officers and to brief biographical sketches of the personnel that have served since these offices were established.

A. DEANS

Duties of the Early Deans of the College of Engineering - At the time the

---

1 University of Illinois Statutes, March 10, 1936, page 3.

office of Dean of the College of Engineering was created the sole function of the Dean was to preside at the meetings of the College faculty -- and about the only business he brought up for consideration concerned changes in the courses of study, requests of students for substitutions, and recommendations of students for graduation; he had little to do with other student affairs. In September, 1894, however, at the beginning of President Draper's administration, the dean became a member of the executive Committee of the General Faculty, which became in 1901, the Council of Administration, and his administrative duties were thereby greatly increased.

Duties of the Later Deans of the College of Engineering - While the dean continued to be the chief executive officer of the College, the duties of his office were little more than nominal and not well defined even as late as 1894. After Engineering Hall was completed in 1894, however, in addition to presiding at the meetings of the engineering faculty, and carrying a heavy teaching load, the dean began to look after affairs pertaining to the students of the College. This work included the supervising of enrollment, the keeping of student records, and the receipt of student petitions. For this purpose he had for a considerable period only the part-time services of a single clerk,[1] for that person also served as stenographer to the several departments. After a time,[2] the dean and the heads of the departments came to act as a body in making the budgets, in distributing funds, and in making recommendations to the president concerning financial policies for the College.

It was not until 1907[3] that the administrative duties of the dean had become well prescribed. The functions of his office became so involved by that time that the dean did no teaching, but gave all his attention to matters requiring executive consideration. In 1909, the dean became also the director of the Engineering Experiment Station, and has served in the dual capacity since that time.

---

1 The Board ordered a typewriting machine and authorized a stenographer for the College to begin January 1, 1895.

2 During Dean White's administration, 1905-07, the executive committee of the heads of the departments came into being, and has continued to date as a permanent factor in the College organization.

3 During Dean Goss' administration.

Preparation of the budget and budgeting relations with the various College departments, frequent representation of the College in University affairs and in public matters, increases in the number of students registered in the College of Engineering, and in the number and size of the departments, growth of the Engineering Experiment Station, and numerous other problems have combined from time to time to multiply the duties and responsibilities of the dean and director. Because final responsibility for the welfare of the entire College rests with him, the dean must be a man possessed with courage and decision and outstanding leadership and vision, one who can bring together and formulate into an integrated whole the considered opinions and recommendations of the College committees and of the several departments in the preparation of plans and policies so that they can operate to the greatest advantage of the College and the University organization.

Appointment of Deans - When the faculties of the four original colleges, Agriculture, Engineering, Literature and Science, and Natural Science were organized early in 1878, a dean of each was elected, as previously stated, by the general University faculty. Since 1894, however, the deans have been appointed by the President with the approval of the Board of Trustees. This was one of the innovations under President Draper's administration and almost his first act.

B. BIOGRAPHICAL SKETCHES OF THE DEANS

General - Stillman Williams Robinson was the first to act as Dean of the College of Engineering. Following his resignation, Professor Nathan Clifford Ricker was elected dean in September, 1878, and held the office continuously for twenty-seven years -- that is, until June 2, 1905, when his resignation was accepted. James McLaren White served as Acting Dean during 1905-06 and as Dean during 1906-07. William Freeman Myrick Goss followed in 1907 and was Dean until 1913, when he took a leave of absence to engage in service for the City of Chicago and from 1915, when he returned to the University, to 1917. Charles Russ Richards was Acting Dean from 1913 to 1915 and Dean from 1917 to 1922. Milo Smith Ketchum followed Dean Richards and served as Dean until 1933. Dean Ketchum was succeeded by Arthur Cutts Willard during 1933-34, who in turn was followed by Melvin

Lorenius Enger, who has continued to date. Short biographical sketches of the lives and affairs of these men follow.

Stillman Williams Robinson, who had been elected Dean of the College of Engineering by the General Faculty of the University on February 15, 1878, presided at the first meeting of the faculty of the College on February 19 of that same year. He continued to serve as Dean until September, 1878, when he resigned to take a position at Ohio State University. Part of Professor Robinson's biography is given under Chapter VII and the remainder under Chapter XI.

Nathan Clifford Ricker, in September, 1878, was asked to become Dean of the College of Engineering and to assume the duties of that office in addition to his regular work as Head of the Department of Architecture. He carried both positions for twenty-seven years, but relinquished the deanship in 1905 to give more time to the claims imposed by the growing needs of his department. The major portion of Professor Ricker's biography, even much that pertains to his work as dean, is given in Chapter IX, the Department of Architecture.

James McLaren White was born in Chicago on October 16, 1867, and was graduated in 1890 from the University of Illinois with the degree of B.S. in Architecture. In September, 1890, he joined the staff of the University as Assistant in Architecture. During 1893-96, he was Assistant Professor of Architecture, and after spending a year in study abroad, he was made Associate Professor. He became Professor of Architectural Engineering in 1901.

In 1905, Professor White was appointed Acting Dean of the College of Engineering and served in this capacity for one year. The next year, 1906-07, he became Dean, meanwhile carrying some teaching in the Department of Architecture. He made an excellent executive and was ever alert to promote the interests of the College; he made many contributions towards the improvement of relations between students and faculty in the College. Most noteworthy of his undertakings was an investigation to determine the relative weights to be assigned to an hour's work of instruction in lecture, quiz, recitation, drafting, laboratory, and surveying

practice.[1]

In 1907, Professor White resigned to accept the newly-created position of Supervising Architect of all University building operations, still retaining his title of Professor of Architectural Engineering. As Supervising Architect he rendered invaluable service in charge of the Physical Plant, and particularly in planning a comprehensive program of campus development. In 1920, under President Kinley, he became also Supervisor of Business Operation and occupied an important position in the administration of University affairs. While still on active duty in this capacity, Professor White passed away on February 6, 1933. He was co-author of one bulletin issued by the Engineering Experiment Station.

William Freeman Myrick Goss, who was appointed Dean when Professor White was made Supervising Architect, was born in Barnstable, Massachusetts, in 1850. He was graduated from Massachusetts Institute of Technology in 1879, was granted the M.S. degree by Wabash College in 1888, and the honorary degree of D.Eng. by the University of Illinois in 1904. From 1879 to 1907, he was a member of the faculty of Purdue University, being successively Instructor in Mechanic Arts, Professor of Practical Mechanics, Professor of Experimental Engineering and Director of the Engineering Laboratories, and Dean of the Schools of Engineering. He was a pioneer in locomotive testing, and designed and installed the locomotive testing plant at Purdue, the first of its kind in the world; and with this equipment he conducted numerous tests which materially added to the knowledge of locomotive performance.

While at Purdue, Professor Goss was the author of three text-books entitled "Bench Work in Wood", ~~and~~ "Locomotive Sparks", and "Locomotive Performance" and of four valuable reports upon researches upon locomotive performance. He was a member of the Jury of Awards of the Columbian World Exposition (Chicago), of the Advisory Board of the U. S. Geological Survey on Fuels, and of the Advisory Committee of the Pennsylvania Railroad of Testing Locomotives at the Louisiana Purchase Exposition (St.Louis).

Although Dean Goss assumed the duties of his office on October 31, 1907, he

1 See Pro. of Soc. for Promo.of Eng. Ed., Vol.XV, page 124 ff.

was not formally installed until February 5, 1908, with exercises in the University Auditorium with Professor James M. White, ex-Dean of the College, presiding. At the convocation, Professor Ira O. Baker gave a short address on "Some Significant Events in the Development of the College of Engineering", President W. L. Abbott of the Board of Trustees spoke on "The Standing of the Technical Graduate in the Engineering Profession", and Dean Goss gave his installation address on the subject "The State College of Engineering."

When Professor Breckenridge resigned in 1909, Dean Goss took over the duties of the Director of the Engineering Experiment Station. In carrying on the work of his office as Dean and Director, Doctor Goss was a most effective administrator. He was a good organizer, a man of vision and of great executive ability, and yet one who carefully attended to details. He had a pleasing personality and a wide acquaintance. He proved to be a very valuable addition to the engineering staff, and contributed greatly in making the College of Engineering of greater prominence and usefulness than ever before. His chief services as Dean of the College were in finding new members of the teaching staff, and in discovering and promoting possible advances in equipment, methods, and buildings; and as Director of the Engineering Experiment Station in considering the investigations to be undertaken, in finding research workers, and in supervising the publications of the results. He, himself, contributed two bulletins to the list of Station publications.

On December 18, 1912, a special engineering convocation was held to permit the general faculty and students in the College of Engineering to express their appreciation of the honor paid to Dean Goss in his election as President of the American Society of Mechanical Engineers. Brief addresses were made by President Edmund J. James and Professor A. N. Talbot, after which Professor Ira O. Baker presented to the Dean a beautifully engrossed testimonial signed by representatives of the faculty and the various engineering organizations. The inscription read as follows;

"Dr. William Freeman Myrick Goss, Dean of the College of Engineering of the

University of Illinois, having recently been installed as President of the American Society of Mechanical Engineers, we, his co-laborers in the College of Engineering, the fellow members of that Society at the University of Illinois, and the students of the College of Engineering, offer this testimonial of appreciation of the honor that has been conferred upon him, an honor richly deserved because of his long and eminent service in the field of engineering education, his researches and contributions to the advancement of engineering science, and his high qualities as a man and friend."[1]

Doctor Goss served as Dean and Director until March, 1917, except during the calendar years 1913 and 1914 when he was on leave as Chief Engineer of the Chicago Association on Smoke Abatement and Electrification of Railway Terminals, in which position, he published his voluminous report of the investigation. He returned to the University on August 31, 1915, and served as Dean and Director until March 1, 1917, when he resigned to become President of the Railway Car Manufacturer's Association, New York City. He retired from this position in 1925, and passed away on March 23, 1925.

Charles Russ Richards was born in Clarks Hill, Indiana, on March 23, 1871. He received the B. S. degree in Mechanical Engineering at Purdue University in 1890 and the M.E. degree there in 1891. He was awarded the M.M.E. degree from Cornell University in 1895. After serving as Instructor in Mechanical Engineering in Colorado Agricultural College during 1891-92, he went to the University of Nebraska, where, between 1892 and 1911, he became successively Adjunct Professor of Manual Training, Professor of Practical Mechanics, Professor of Mechanical Engineering, Associate Dean of the Industrial College in charge of Engineering, and still later after the reorganization of the Colleges of the University, Dean of the College of Engineering.

While at Nebraska, Professor Richards introduced the curriculum in Mechanical Engineering and later designed the Mechanical Engineering building. On this building he made all the drawings with his own hands, personally wrote the specifications and supervised the construction, all without the help of even a clerk or draftsman and in addition to his regular work, to the end that all of the money might go into the building, which was generally conceded to be one of the finest of its kind in the country. This was an example of the devotion which an earnest and interested

1 The Technograph, page 103, Feb.1913, No.2, Volume XXVII

teacher gave to his work. He was consulting engineer for the City of Lincoln in the erection of the municipal lighting plant and the improvement of the city water-works. He exerted a powerful influence in building up a strong Department of Mechanical Engineering in a non-manufacturing state.

Professor Richards came to the University of Illinois on September 1, 1911, as Professor of Mechanical Engineering and Head of the Department. One of his outstanding achievements after coming to the University of Illinois was to design and supervise the radical reconstruction of the Mechanical Engineering Laboratory building. He also directed the reorganization of the shop work, which is described in a later chapter. During his administration marked progress was made in instructional methods. In the selection of members of his staff, Professor Richards' judgment and foresight were of special value. He served as Acting Dean and Director from July 1, 1913, to August 31, 1915, during the absence of Dean Goss and was Dean and Director from March 1, 1917, to July 31, 1922.

It was one of Dean Richards' outstanding characteristics to be systematic in his office work and prompt in his official duties. He was always cordial and courteous, and was readily accessible to those having occasion to see him. His genial smile made friends of everyone he met. His frankness, kindliness, and honesty in his dealings with the staff were responsible for the earnestness and loyalty of all the faculty. He was a most agreeable friend and an excellent officer, courageous and efficient in presenting the needs and in defending the interests of the College of Engineering before University authorities. He embraced every opportunity to present the work of the College and the Station before engineers and manufacturers. He was much interested in research and was ever ready to do all in his power to help along such work and to stimulate instructors to engage in it. He was author of one bulletin and one circular and co-author of of two bulletins of the Engineering Experiment Station.

Dean Richards served as Director of the American Society of Mechanical Engineers during 1918-20. He was awarded the honorary degree of Doctor of Engineering by the University of Nebraska in 1920. He resigned from the University of Illinois

September 1, 1922, to become President of Lehigh University. All connected with the University were exceedingly sorry when he resigned, and as a measure of its esteem, the College of Engineering at a farewell dinner given in his honor, on June 6, 1922, presented to him the following testimonial to which every member of the staff in the College had affixed his signature:

To Charles Russ Richards:

"As you leave the University of Illinois, we wish to express the pleasure we have had in our association with you and our regret that it must now be interrupted.

"In our dealings with you as Dean of the College of Engineering we have prized especially the sympathetic cooperation, the frankness, the impartiality upon which we have all come to rely. We have felt ourselves, as a faculty, safely and adequately and vigorously represented both within and without the University. We shall always remember the cordiality and sincerity that have marked our personal as well as our official relations.

"We assure you of our appreciation of the important contribution you have made to the progress of the College of Engineering through the sound judgment and vision with which you have administered its affairs.

"Our regret in having you go from us is tempered by our pride in your election to the presidency of Lehigh University. We heartily wish you the highest measure of success in that position, and the fullest opportunities for service and accomplishment in the years to come."

Urbana, Illinois
June, 1922

In 1923, Doctor Richards was honored with the degree of LL. D. by Lafayette College. He continued in his position as President of Lehigh until 1935, when he retired because of ill health. He passed away at the home of his daughter in Minneapolis, Minnesota, on April 17, 1941.

Milo Smith Ketchum was born at Burns, Illinois, on January 26, 1872. He was graduated from the curriculum in Civil Engineering at the University of Illinois in 1895 and served as Instructor in Civil Engineering and Mathematics from 1895 to 1897 and as Assistant Professor from 1899 to 1903. He received the professional degree of Civil Engineer from the University in 1900. He was engaged as bridge and structural engineer for the Gillette-Herzog Manufacturing Company from 1897 to 1899 and as Contracting Manager for the American Bridge Company at Kansas City in 1903-04. In 1904, he became Professor of Civil Engineering at the University of

Colorado, and next year Dean of the College of Engineering. Except in 1909-10, when he was on leave of absence to become associated with H. S. Crocker, Past-President of the American Society of Civil Engineers, in the firm of Crocker and Ketchum as Consulting Engineer at Denver, he remained with the University of Colorado until 1918, when he was made Assistant Director of the U. S. Government Explosive Plants, in charge of the construction of the mammoth smokeless powder plant at Nitro, West Virginia. He remained in that position until 1919 when he went to the University of Pennsylvania as Professor and Head of the Department of Civil Engineering, and remained there until September 1, 1922, when he returned to the University of Illinois as Dean of the College of Engineering and Director of the Engineering Experiment Station.

The Dean was formally inducted at an all-engineering convocation in the University Auditorium on March 7, 1923. On that occasion, the Engineering students and faculty assembled in front of Engineering Hall and marched to the Auditorium led by a band composed of engineers. President Kinley presided at the meeting, while E. J. Mehren, '06, Editor of Engineering News-Record and Vice-President of the McGraw-Hill Publishing Company, was the principal speaker, the subject of his address being "The Importance of Research to the Progress of Industry." Dean Ketchum's response was "Engineering Education and Research." Speeches of welcome to the new Dean were made by William Lamont Abbott, President of the Board of Trustees, and by Arthur Newell Talbot, Professor of Municipal and Sanitary Engineering in charge of Theoretical and Applied Mechanics.

Dean Ketchum's tenure included a trend of expansion and improvement in buildings, laboratory equipment, and instructional and research staff, as well as a further enhancement in the standing and reputation which the College of Engineering enjoyed among the schools of the United States.

As a token of their appreciation of the service during the first ten years of the administration, the members of the College and their wives and guests tendered Dean and Mrs. Ketchum a formal "Ten-Years-of-Progress" dinner at the Champaign Country Club on the evening of May 25, 1932. Professor Talbot presided and gave

the opening address on the subject "The College of Engineering and Its Development". Dean Jordan then followed with an address on "Ten Years of Progress in the College of Engineering."

Professor Ketchum was joint author with Professor Pence of a popular manual for field practice in surveying entitled "Surveying Manual." He was author of five important and well-known books on structural engineering entitled "Design of Highway Bridges of Steel, Timber, and Concrete", "The Design of Mine Structures", "Design of Steel Mill Buildings", "Design of Walls, Bins, and Grain Elevators", and "Structural Engineer's Handbook." He was co-author of one bulletin of the Engineering Experiment Station, and contributed many articles to the technical press. He served as Director of the American Society of Civil Engineers from 1918 to 1920 and as Vice-president during 1925-26. He was President of the Society for the Promotion of Engineering Education in 1917-18. He received the honorary degree of Doctor of Science from the Colorado School of Mines in 1926 and from the University of Colorado in 1927.

Due to declining health Dean Ketchum retired from his duties as Dean on July 1, 1933. Because he was not eligible for retirement under the regular University plan, he was made Research Professor of Civil Engineering. He maintained an office at 108 Engineering Hall, and directed research work on stresses in bins and similar structures under granular loading. He was made Dean Emeritus, however, in 1934, and died in Urbana on December 19 of that year.

The following tribute seems to be appropriate as a fitting resume of the work of the man who for eleven years served the College of Engineering as its chief executive officer:

"Dean Ketchum had the personal qualities which command the respect and inspire the admiration and confidence of students. He understood and made allowances for the unconventional impulses of youth. He was stern, yet sympathetic; his discipline was swift and positive, but just; and his understanding of student problems, social, economic, and educational, was born out of his own wide experience. He knew how to stimulate students to greater effort, and the success of the means by which he accomplished it was due largely to the example he set in doing his own work."[1]

1 The Technograph, Volume XLIX, February, 1935, No.3, page 3.

Arthur Cutts Willard, who during the administration of Dean Ketchum was Head of the Department of Mechanical Engineering, followed the Dean in office after his resignation in 1933. Unwilling to accept the appointment permanently, Professor Willard became Acting Dean on July 1, 1933, and held that position until July 1, 1934, when he became President of the University. The greater part of Professor Willard's biographical sketch is given in Chapter III under Presidents. The remainder appears in Chapter VII under Mechanical Engineering.

Melvin Lorenius Enger was born on May 5, 1881, at Decorah, Iowa. He received the B.S. degree from the University of Illinois in 1906, the C.E. degree in 1911, and the M.S. degree in 1916. After spending two years in railway service with the Chicago, Milwaukee, and St.Paul Railway, he came to the University in 1907 as Instructor in Theoretical and Applied Mechanics. He was made Associate in 1909, Assistant Professor in 1911, and Associate Professor in 1917. In 1919, he was appointed Professor of Mechanics and Hydraulics, and in 1926 was made Head of the Department of Theoretical and Applied Mechanics. He continued in that position until 1934, when he was made Dean of the College of Engineering and Director of the Engineering Experiment Station, which positions he has held to date (1945).

He was an excellent teacher, a helpful administrator, and a generous contributor to educational and technical literature. He is joint author of two bulletins of the Engineering Experiment Station. He is an active member of a number of engineering societies and was Director of the American Society of Civil Engineers during 1932-34. There is no doubt that under Dean Enger's counsel, leadership and direction, the College of Engineering will continue to grow and expand to a position of even greater pre-eminence among the technical institutions of higher learning in the United States.

C. OFFICE ACCOMMODATIONS

General - When Professor Robinson served as Dean in 1878, his office as Professor of Mechanical Engineering was located in University Hall, but he had no special office as Dean. Likewise Professor Ricker who followed him had no special quarters to carry on his duties as Dean. When Engineering Hall was opened in

1894, however, Room 300, a small room on the third floor of that building, was assigned to the office of the Dean of the College. Both Dean Ricker and Dean White had the use of this limited space. When Dean Goss came in 1907, he took over the larger room adjacent on the west, 302, which had been used previously as parlors for faculty meetings and later as an office by Professor L. P. Breckenridge, Head of the Department of Mechanical Engineering and Director of the Engineering Experiment Station. He used Room 302 for his own private office and assigned Room 300 to the College secretary. Later Room 304 was added to the suite for the Dean's stenographers. The office of Dean remained there until 1930, during the administration of Dean Ketchum, when it was moved to Rooms 103 and 105 on the first floor of Engineering Hall. In 1935, however, the office was moved to a suite of rooms, 104, 106, and 107, in the southwest corner of Engineering Hall where it would be more accessible to the quarters of the Engineering Experiment Station, and where it has remained to date (1945).

D. ASSISTANT DEANS

General - At the beginning of his administration, Dean Goss made arrangements for an assistant dean to advise students regarding their University problems and to direct the keeping of student scholastic and personal records, and to maintain discipline wherever necessary. The appointment of such an assistant not only relieved the dean of much routine responsibility in connection with the growing registration, thereby enabling him to give his undivided attention to the larger problems requiring consideration, but also served a very useful purpose in the administration of student affairs. The duties of the office have multiplied steadily through the years with the increase in student enrollment and the number of curricular and elective courses offered by the various departments.

E. BIOGRAPHICAL SKETCHES OF ASSISTANT DEANS

General - In 1907-08, Professor Floyd Rowe Watson of the Department of Physics devoted three half days a week to the office of Assistant Dean. During the years 1908-10, Assistant Professor Fred Duane Crawshaw took over the office being in charge of General Engineering Drawing also during that same time. During 1910-12,

Assistant Professor William Thomas Bawden served as Assistant Dean, while from 1912 to 1917, Harry Willard Miller, who was Associate in General Engineering Drawing, took on the duties of the office. Professor Harvey Herbert Jordan then followed as Assistant Dean and continued under that title until 1934, when he became Associate Dean with the same duties he previously performed. Biographical sketches of these men follow.

Floyd Rowe Watson - Since Professor Watson's biographical sketch is given under Physics, it is not repeated here.

Fred Duane Crawshaw received the B.S. degree from Worcester Polytechnic Institute in 1896 and the M.E. degree there in 1908. Before coming to Illinois he had had experience in public-school work and as Instructor at Bradley Polytechnic Institute. He served as Assistant Dean of the College of Engineering and in charge of General Engineering Drawing at Illinois from 1908 to 1910, after which he resigned to become Professor of Manual Arts in the University of Wisconsin. During 1917-18 he served as President of the Academic Board of the U. S. School of Military Aeronautics at the University of Illinois, and during 1918-19 he was Professor of Industrial Education and Assistant to the Director of the Engineering Experiment Station at the University. He resigned this position to engage in commercial work. He was the author of several textbooks on manual training and of one text on mechanical drawing for secondary schools.

William Thomas Bawden received the A. B. degree from Dennison University in 1896, the B.S. degree from Columbia University in 1903, and the Ph. D. degree there in 1914. Before coming to Illinois he had had teaching experience in public schools and from 1902 to 1910 had served as Director of the Department of Manual Training at the Illinois State Normal University at Normal. He was Assistant Dean of the College of Engineering at Illinois during 1910-12, after which he resigned to accept a position with the U. S. Bureau of Education at Washington, D.C.

Harry Willard Miller, Assistant Professor of General Engineering Drawing, continued to give something more than half his time to the duties of Assistant Dean of the College of Engineering from 1912 until 1917, when he resigned to enter military service. One of the things inaugurated by Assistant Dean Miller in

1913-14 and which has been continued to this day was the photographing of each freshman early in the year, before a mirror in such manner as to show both the front and the side view of the face; and taking similar photographs of the seniors late in the year before graduation. These photographs are of interest in showing the change in features during the four years; and are of great value in identifying students, particularly when making recommendations of students for positions in industry. Additional materials relating to Professor Miller's biographical sketch appears under Chapter XVII, General Engineering Drawing.

Harvey Herbert Jordan, Assistant Professor of General Engineering Drawing, was made Assistant Dean in September, 1917. Like Assistant Dean Miller, Assistant Dean Jordan was particularly efficient, being resourceful and energetic, orderly and systematic in keeping records, tactful but prudent, firm but sympathetic in dealing with students, and being able to carry many details accurately in mind. He became Associate Dean of the College in 1934. The remainder of Dean Jordan's biographical sketch is given under Chapter XVII, General Engineering Drawing.

F. OFFICE ACCOMMODATIONS

General - In 1908, the assistant dean of the College of Engineering took over Room 301 Engineering Hall for use as his private office. In 1921, Room 303, the room previously occupied by Professor O. A. Leutwiler as an office was annexed for stenographic purposes. By the time the dean's office was moved from the third floor to the first floor of Engineering Hall in 1930, the work of the assistant dean had become so heavy that he took over the large room, 302, formerly occupied by the dean. This gave the assistant dean a suite of four offices in which to carry on the administration of his College duties.

G. OTHER ASSISTANTS
a. In the College and the Station

Marie Huber, (A.B., 1929, in L.A.& S. at the University of Illinois), who served for a number of years as Secretary to Dean Richards, Dean Ketchum and Dean Enger, was appointed Assistant to the Dean and Director of the Engineering Experiment Station in 1932. Miss Huber has served most efficiently in the discharge of the duties of her office, thereby relieving the Dean and Director of such

responsibility, and enabling him to devote his time to the general problems of administration.

b. In the station

General - Brief sketches of personnel assigned to the Station are considered under the chapter dealing with the Station activities, and are not included here on account of lack of space.

H. SUMMARY

General - The seventy-six years of growth of the College of Engineering have seen the administrative office expand from what was little more than a name in the 1870's with duties that were extremely simple, to a complex and complicated organization in the 1940's that requires a sizeable staff with corresponding office and equipment accommodations to carry on the vast program of administering the affairs of a dozen departments having a combined staff of over 200 persons offering instruction to almost 2000 students registered in the College to say nothing of the hundreds coming for training from other colleges within the campus area. To maintain discipline and student records for such a group of registrants requires the full-time services of a substantial and well-trained staff. Then the problems relating to experimentation and extension teaching command a considerable amount of attention. Then to this list are added the duties involved in public relations and an endless number not so readily classified, it becomes evident that the task of administration of the College of Engineering here demands an inestimable amount of exacting effort requiring skill and tact, resourcefulness and ingenuity, sympathetic understanding, and courage, vision and technical ability.

CHAPTER VI

BUILDINGS AND GROUNDS DEVOTED TO ENGINEERING PURPOSES

A. GROUNDS

Land Acquired in 1867[1] - The land donated to the University by Champaign County in 1867 included a tract of 7 ½ acres that was intended to serve as a campus for the Urbana and Champaign Institute. As the County pledged ten acres to be included in the grounds, it made up the difference by conveying ten lots which it owned adjacent to the campus. About the same time, a tier of lots along the west side of the Institute grounds was purchased by the University, moving Wright Street about 66 feet west from its original location. The west 14 feet of this strip, however, was added to Wright Street, making it 80 feet wide. The other 52 feet of the original street became a part of the campus.

During the year 1867, twenty-two lots lying between the Institute grounds and Springfield Avenue were purchased, and at the same time, nearly all of a 40-acre tract 40 rods wide from east to west extending 160 rods south from Springfield Avenue to a tract of land already owned by the University. Those portions of White and Stoughton Streets that crossed the campus were then vacated by the City of Urbana, and, the city vacated the alleys running through blocks 52 and 53 in accordance with the special Act of the General Assembly. The City of Urbana was permitted, however, to extend Green Street across the campus, it and Springfield Avenue being the only thoroughfares extending east and west through the engineering grounds.

At the end of 1867, then, the campus proper adjacent to the central building, lay north of Springfield Avenue and included all of what is now Illinois Field -- a tract about 460 feet wide and 1260 feet long, making in all about thirteen acres consisting of ornamental and military-parade grounds. The total area occupied by the University at that time in addition to the campus space was 1,005 acres,[2] made up mostly of orchard, stock, and farm land.

Land Acquired from 1867 to 1893 - In 1886, several lots constituting a total

1 Much of the material for this description was taken from "Sixteen Years at the University of Illinois" by President James.

2 Four hundred acres of this, the Griggs farm, was afterwards sold.

of $4\frac{1}{2}$ acres lying in a tier of 198 feet wide from east to west along the east line of the campus, was added from Springfield Avenue south. Several lots near the right of way of the railroad line that were not included in the 40-acre tract purchased in 1867, were also taken over after 1869.

Land Acquired Between 1893 and 1916 - Two lots on the west side of Mathews Avenue and north of Green Street were purchased by the University in 1905, and three lots on the southwest corner of Mathews Avenue and Springfield were purchased in 1916. These two purchases completed the ownership by the University of the entire block of ground bounded by Mathews, Springfield, and Burrill Avenues, and Green Street.

Eight lots between Mathews and Goodwin Avenues and between the Boneyard and the railway tracks were acquired one by one during 1911 and 1912 -- the houses being sold and moved away. This block, about 300 feet by 400 feet, containing approximately three acres, was all utilized for University buildings within the next five years.

During 1913-14, the University purchased thirteen lots lying east of Goodwin Avenue between the Boneyeard and the railway tracks. This tract also comprised about three acres. Three additional lots adjoining these were purchased in 1915. Part of this space thus acquired east of Goodwin Avenue, was used for coal storage, part for store and service buildings maintained by the Physical Plant Department, and part for the erection of small experimental buildings for the use of the College of Engineering.

Land Acquired after 1916 - Two lots immediately south of the Boneyard on the west side of Goodwin Avenue were acquired about 1930 or 1931 for the use of the State Geological Survey. The northernmost of these was occupied by the Survey laboratory and garage, which later was taken over by the Department of Physics as the Nuclear Radiations Laboratory to house the new cyclotron. During the latter part of 1943, the University obtained title to about 762 acres of land lying southwest of Savoy for an airport. This is included as parts of Sections 2,3,10, and 11, Tolono Township, and is described in some detail under University Airport.

B. BUILDINGS OCCUPIED IN COMMON WITH OTHER COLLEGES

General - During the early days, a number of University buildings were used in common with other colleges and departments for engineering office, classroom, museum, and laboratory purposes. In order to make the record more complete, some of these are described briefly in the following pages of this chapter.

University Building - The first building used by the University was Old University Hall, which stood about midway between Wright and Romine Streets in Urbana near the north end of what later came to be Illinois Field -- the north side of the building being about on line with the north side of Clark Street. The building, erected in 1861-62 for the use of a local co-educational boarding school to be known as the "Urbana and Champaign Institute", was donated to the State for University purposes shortly after its completion, as a part of the original pledge or endowment by Champaign County. It was reputed to have cost $175,000 and to have been one of the most substantial educational buildings in the State, second only to the one at Normal. It was a five-story brick structure with the main entrance on the north facing University Avenue and a side entrance on Wright Street. The building measured 125 feet east and west and had a width of 40 feet. It had a 44-foot by 70-foot central wing on the back, or south side, four stories high.

The front of the building was used for recitation and dormitory purposes, while the wing contained more recitation rooms, a chemical laboratory fitted up in the summer of 1868, a kitchen, and a dining room. The building was originally constructed with sixty living rooms that were used as private study and living quarters for about 130 students. Its classrooms would accommodate over 400 students. The chapel was located in the fourth story of the wing, and, provision was made in the building for the University Library.

All recitations were held in this building from the opening of the University in March, 1868, until December, 1873 -- the time of the completion of University Hall. After that it became known as the "Old Dormitory", for many living rooms were added to the sixty already available when several of its classrooms were converted into study and living rooms for student use. The only part used for

instructional purposes after 1873 was two rooms that were occupied by the chemical laboratory until the new Chemistry Building (now Harker Hall) was completed in 1878.

The west wing of the structure was partially destroyed and rendered untenable by a violent wind storm in the spring of 1880; and in June, the building was ordered to be taken down, because there was no money available for its reconstruction or repair. The building was razed between June and September, 1881.

University Hall - In March, 1871, the site for the new main building was located and a Mr. Van Osdel of Chicago was chosen as architect. The Legislature appropriated the first $75,000 for the structure to cost $150,000.[1] The cornerstone of this New Building, "Old Main Building", or University Hall, as it was designated at different times, was laid on September 13, 1871. The Legislature in 1872, however, appropriated only $41,550[2] for completing and equiping the building because of emergency appropriations following the Chicago fire. In order to finish the structure, the University had to use some of the Champaign County endowment bonds that it still held; and because it was necessary to reduce the cost, the building was not erected exactly according to the original design. The building was completed, nevertheless, in accordance with revised plans in time for the opening of the school year 1873-74, at a cost of $148,000 exclusive of furniture and heating apparatus, and was formally dedicated on December 10, 1873. The structure, erected in the form of a U with the front facing north, was five stories, or 145 feet high, and measured 214 feet along its north front and 124 feet along its wings.

Upon its completion, the building, containing sixty rooms arranged for class-room, lecture, drafting-room, laboratory, library and reading-room, museum, and literary-society purposes was indeed the "Main Building" in fact as well as in name, for it was used jointly by substantially all departments of the University when all class work was moved from the Old University Building, or "Old Dormitory" except drill and field courses, and chemistry, which remained there until its own

1 Report, University of Illinois, 1870-71, pages 15-16
2 Report, University of Illinois, 1872-73, page 148.

laboratory was completed in 1878. Thus, from December, 1873, until January, 1895 when the new Engineering Building was occupied, all engineering work, except shop practice in mechanical engineering and architecture, was carried on in this building.

As used in its earlier days, the east or chapel wing, contained the chapel auditorium itself that occupied a room which measured 61 by 77 feet located on the second[1] floor and which would seat about 700 persons. The physics lecture room measuring 51 by 61 feet was located directly above the chapel and had an apparatus and laboratory room adjoining it on the north. Other rooms in this wing were used by the schools of architecture and art and design.

The library or west wing was fireproof. One room measuring 61 by 77 feet located on the ground floor contained the Museum of Natural History. Another room directly above it on the third floor, and of the same size, was used for the University library and reading room. Other rooms in this wing contained the Art Gallery, and the Museum of Engineering and Architecture, later designated the Museum of Industrial Art.

The main part of the building had thirty classrooms of good size, and a number of offices, one of which, located on the third floor almost directly above the front entrance, was occupied by the Regent. In addition there was a store room and there were cloak and rest-room accommodations for both men and women. After 1907 several large rooms located on the upper floor were remodelled and were given over solely to the use of the student literary societies.

For a number of years, the building was heated by steam from boilers located in the east wing of the basement. Later, however, steam was provided from central plants.

As used in its later days practically the entire building[2] except those

1 In the early-catalogue references to this building, the ground floor was called the basement, the main floor the first floor, and so on. In this publication, however, the ground floor is called the first floor, the main floor the second, and the top floor the fifth.

2 It is note of interest to mention that on September 10, 1900, the University opened a dining room on the ground floor of the building under the chapel and operated it there until June, 1903.

portions of the top floor that continued to house the literary societies, was used for classrooms and offices by the College of Liberal Arts and Sciences.

In time, in spite of all ordinary efforts to maintain the structure in good repair, it began to show signs of failure, whereupon unusual steps were taken to preserve it, one of which was to reinforce it by means of a substantial steel post that extended from the basement to the roof line of the east tower and served to prolong its period of usefulness for a number of years. Finally, however, in 1938, the building had to be razed, for it had been declared unsafe for further occupancy.

This building was closer to the hearts of the alumni than any other structure or part of the University campus; and any time that proposals were made to raze it, vigorous protests came in from every direction. The traditions handed down from one generation to another had become almost sacred, and the sentiments that prevailed among faculty, students, and alumni alike as the result of its long association with campus life, were almost as strong as those due to family ties. Because of these feelings and reactions every reasonable effort was made to retain the building and its period of serviceability, but the time had finally come, when it had to come down, for it was entirely unsafe for further use.

Old Chemistry Building[1]- Because portions of the old Chemistry Building which was erected between July, 1877, and April, 1878, at a cost of $40,000, were used at different times for laboratory and society rooms by some of the departments in the College of Engineering, this structure is included in the list of buildings described.

This structure, 74 feet by 126 feet, four stories high, now known as Harker Hall, was at the time of its completion, one of the largest and best chemical laboratories in the country. The main entrance, a somewhat pretentious affair, was located on the north side and led directly to the second or main floor. The roof was of the mansard type like the one on University Hall.

---

1 Original building designed by Professor Ricker. It was dedicated during the Commencement exercises in 1878.

In August, 1896, the building still occupied largely by chemistry and its stock of laboratory supplies, was struck by lightning -- the resulting fire destroying the roof and practically all of the interior so that nothing of value remained except the four external brick walls. The loss was estimated to be $40,000. The roof was restored in good order at once although on very different lines, but the interior was replaced in a very hasty and incomplete fashion because of lack of time and money. The interior was later refinished, with more substantial materials; and in March, 1902, the building was turned over to the College of Law. In 1909, the northern entrance was remodelled, when the outside stone steps were removed and replaced by an inside stairway.

The building continued to be used by the College of Law until 1925, after which it was occupied for a time by a number of departments. In 1927, however, a portion of it was definitely assigned to the Department of Entomology and has been used by it to date, while in 1930, the second floor was rearranged to some extent and assigned to the Department of Botany. It is the oldest major building now standing on the Urbana campus.

Old Armory or Gymnasium Annex - The Military Building, or what is now the Old Armory or Gymnasium Annex,[1] completed in May, 1890, measures 100 feet by 150 feet and is one story high. It was considered at the time of its erection to be a grand and spacious hall, giving ample room for company and battalion maneuvers. For a number of years it was used for commencement exercises, having been formally dedicated when commencement was first held there on June 11, 1890. Other large gatherings like class and military dances were also assembled there upon special occasions.

In September, 1897, the building was taken over for gymnasium purposes, for there was no military drill then on account of the fact that all of the military officers had gone away to duty in the Spanish-American War. On March 5, 1898, however, the gymnasium was moved to the top floor of the Old Mechanical Building and Drill Hall or Wood Shop and Testing Laboratory as it was then known, when

---

1 Designed by Professor N. C. Ricker

military drill was resumed, but was moved back into the old Armory again in September, 1900, after the Wood Shop and Testing Laboratory had been destroyed by fire in June of that year.

The name of the building was changed to Gymnasium Annex in 1915, when the structure was adapted to physical-training use after the new Armory was completed on the south campus area.

In 1918 a 50-foot addition, known as the Engine Annex, was constructed along the east side for the use of the U, S. School of Military Aeronautics in giving instruction on airplane engines during World War I. In the summer of 1942, another addition was provided along the north side to afford greater housing facilities for the Navy Training School stationed at the University during World War II.

C. BUILDINGS ASSIGNED PRIMARILY TO THE COLLEGE OF ENGINEERING

General - All of the buildings except the first two, erected primarily for the use of the College of Engineering, still stand and are in constant use. These, forming a compact group located on the north campus, constitute a working center for all concerned with instruction in engineering. The close daily contact of students of all four classes in the College, from the freshman through the senior year, serves to unite them in a common purpose, thereby developing a spirit of college unity and professional morale. Their interests are broadened, at the same time, through contact with students in other colleges of the University, in classrooms on other parts of the campus -- the most common points of such assembly being for instruction in matematics and those other subjects given by the College of Liberal Arts and Science that constitute an important part of the first two years' work in engineering.

The development of the College in a physical sense is illustrated by its growth from a single shop building in 1870 to a well-integrated campus of fourteen[1] spacious buildings in 1945, containing about 50 classrooms, 25 drafting rooms, 70 laboratories, and a corresponding number of offices, a number of supply, storage, instrument, and other auxilliary rooms. These buildings including the two that

1 One additional -- the Civil Engineering Surveying Building--is located on the South campus.

have been removed, are described briefly in the following pages.

First Mechanical Engineering Shop Building - The first building devoted primarily to engineering instruction was originally a one-story 24 by 36 foot wooden structure which had previously been used as a farm tool-house and mule stable, and which stood at the southeast corner of Wright Street and Springfield Avenue. In January, 1870, after a second story had been added to ~~the~~ house, the University carpenter shop, the lower floor was set apart for the use of a shop for the Department of Mechanical Engineering. Later, the building became a students' dormitory, and was ultimately moved to the southwest corner of Wright and Clark Streets in Champaign and became part of a dwelling house.

Mechanical Building and Drill Hall[1] - In 1871, a two-story brick and stone building, 88 feet by 126 feet, costing $25,000, was erected near what is now the southeast corner of Springfield and Burrill Avenues, and was opened on September 13, of that year -- the same date as the laying of the corner stone of University Hall. It was occupied jointly by the Departments of Mechanical Engineering, Architecture, and Military Science -- Mechanical Engineering and Architecture using the first floor for shop purposes, and Military Science the second, for a drill hall.

The first floor contained a boiler, forge and tank room; a machine shop furnished for practical use with a steam engine, lathes and other machinery; a pattern and finishing shop; carpenter and cabinet-working shops furnished with wood-working machinery; and paint, printing, and drafting rooms.

The Drill Hall was 80 by 120 feet in size. One of the towers contained an armorer's shop and military model room, an artillery room, and a band room. The other tower contained a printing office and editor's room. A gallery holding about 300 persons was above the second floor.[2]

In 1885, a one-story addition 32 by 36 feet was constructed at the southwest corner for a blacksmith shop. This was equipped with sixteen forges and with

1 Called Mechanical Building and Drill Hall from 1871 to 1887; Mechanical Building from 1887 to 1891; Machinery Hall from 1891 to 1895; Engineering Laboratory from 1895 to 1897; Wood Shops and Testing Laboratory from 1897 to 1900; and Old Armory generally.

2 Commencement exercises were held in the Drill Hall until 1890

anvils and tools, and with a cupola for melting iron.

In 1889-90, a separate building was erected for military purposes, and the upper floor of this Mechanical Building was devoted to a machine shop and the mechanical wood shop, tool room, and pattern and store room. The first floor including the addition continued to serve the forge shop, foundry, wash room, and architectural shop for carpentry and cabinet work. One room on this floor served as a repair shop and was in charge of the Superintendent of Buildings and grounds. As the laboratories of mechanical engineering and applied mechanics and hydraulics developed, they were given space on this first floor also.

When the Metals Shop, or what is now known as the Machine Tool Laboratory, was completed in 1895, the Department of Mechanical Engineering moved its metal-working machinery into it, leaving the first floor devoted to a wood shop, a materials-testing and hydraulic laboratory, and the mechanical-engineering laboratory. In March, 1898, near the beginning of the third quarter, a portion of the upper floor was taken over for a University gymnasium for men. While it was not ideal in appearance, it was adequately furnished and well-adapted to practical use. It was fitted with a satisfactory supply of lockers and with reasonable toilet and bathing facilities. In 1898, too, when the Mechanical and Electrical Engineering Laboratory was completed, the equipment of the Mechanical Engineering Laboratory was transferred into it, leaving the first floor of the old building to be occupied by the wood shops and the materials-testing and hydraulic laboratories.

A day or so after Commencement in June, 1900,[1] the entire structure and all of its contents were destroyed by fire, with an estimated loss of $76,000 as previously stated. During the next year, there was erected on the same site, as described later, a building devoted to instruction in wood-shop practice.

1"At two o'clock Saturday morning, June 9, the oldest building on the campus, which accommodated our Wood Shops, Testing Laboratory, Hydraulic Laboratory, Gymnasium etc., was entirely destroyed by fire. The origin of the fire is unknown. Before we were aware that the building was on fire at all, it was beyond all hope. In an hour nothing was left but the outside walls.

"This entails upon the University another very serious loss. While the building was an old one, it was substantial, and it was exceedingly useful. The resulting inconvenience will be great." -Report of the University of Illinois, 1900, pg. 301

This was in every way a substantial and rather pretentious looking building, but because it was designed after the pattern of the traditional armory, it gave the campus more of the appearance of a young military academy than of an embryo university. No doubt, during the almost twenty years that it served in part as an armory, it did add some interest to military training, but after it came to be used only for laboratory purposes, its outlines must have seemed a little extraneous.

Engineering Hall - One of the most momentous events in the early part of the career of the College was the erection in 1893-94 of the Engineering Building or Engineering Hall as it came to be called. From the beginning of Acting Regent Burrill's administration, there was much formal and informal discussion regarding the extent of the University's askings of the Legislature in 1893, particularly for buildings. Certain members of the University faculty felt that there should be a new natural-history museum, and submitted a strong memorial supporting that view. Others charged that the chief need was a new library. The members of the engineering faculty urged, however, that much larger quarters were needed by the College of Engineering to care suitably for its students and to extend properly its work, and called attention to the fact that for several years past considerably more than half of the men students had been registered in the College of Engineering. Neither the faculty nor the Board of Trustees was willing to decide as to the relative merits of the demands for these three buildings, but asked the Legislature for all of them. An active campaign was carried on by all three groups; but the ratio in the number of students involved, the standing attained as an engineering school, the achievements of its graduates, and the great need for additional space for the proper development of the College as a whole, served to impress the General Assembly as to the importance of a separate building for engineering use. The outcome was that authority for the building was granted -- the appropriated sum being $160,000 -- and the requests of the other groups were deferred.

After the appropriation was alloted, according to the 1893-94 issue of the University Catalogue, the Board of Trustees asked for competitive plans from the

Architectural graduates of the University for the design of the building. As a result of this competition, the Board awarded the first prize to George W. Bullard, Tacoma, Washington, of the class of 1882, who was made architect of the building. His plans called for a four-story structure with a central wing on the back. The site chosen for its location was on the north side of Green Street, midway between the north and south group of buildings, facing the latter. Construction work was started late in 1893, and the cornerstone was laid during formal exercises, on December 13, 1893, Dr. Robert H. Thurston of Cornell University giving the principal address. The structure, completed late in the fall of 1894, was formally dedicated with appropriate ceremonies on the 15th of November of that year --the same day as the formal inauguration of President Draper. The program of dedication is indicated in the following outline:

Overture - "World's Peace Jubilee", (Beyer)-University Military Band

Introductory Remarks -- President Draper

Music - "On Deck Polka" (Krall)-University Mandolin Club

Address -President Charles Kendall Adams, LL.D., University of Wis.

Music - "Down by the Riverside" - University Glee Club

Address - General William Sooy Smith, of Chicago

Overture - (Theo.Mozas) - University Orchestra

Benediction

President's Reception, 9:00 P.M. - Engineering Hall[1]

The building, still standing and in constant use, with the exterior practically unchanged from the date of its construction, has a frontage of 200 feet, a depth of 76 feet on the wings and 138 feet on the center. The rear central wing is 72 feet wide. The first story is of drab limestone laid in twelve-inch courses having a tooth-chiseled finish and deeply-chambered joints, while the three upper stories are of buff pressed brick with terra-cotta trimmings to match. The interior is slow-burning mill construction. The ceiling is paneled Washington fir, and the remainder of the interior finish is oak and was originally fitted with

1 Eighteenth Report of the Board of Trustees, page 36-37

bronze trimmings.[1]

The building was first occupied at the beginning of the Winter Term of 1894-95 ~~to 1895~~. In the assignment of rooms, each department was provided with an office, ~~or~~ one or more private studies for instructors, a seminary room, class and drafting rooms, and a cabinet room. The offices were equipped with curtain-top desks, Shannon filing cabinets, letter presses, card indexes, and other cabinets designed to meet the needs of each department.

The Catalogue of 1894-95 contained this statement:

> "The first story of the west and central wings contains the laboratories of ~~the west and central wings contains the laboratories of~~ the department of electrical engineering, while the east wing is devoted to masonry laboratories and instrument rooms of the department of civil engineering. The central wing of the second story contains the lecture room and the preparation rooms of the department of Physics, the remainder of the floor is used by the departments of Civil Engineering and Municipal and Sanitary Engineering for recitation and drawing rooms cabinets and studies. The middle wing of the third floor contains the laboratories of the department of Physics, and the side wings the drawing rooms, lecture rooms, cabinets, and studies of the Mechanical Engineering department. The central portion contains the library, the office (business office of the dean) and the faculty parlor. The fourth story is devoted entirely to the department of architecture, and contains drawing and lecture rooms, cabinets, photo studio and blue print laboratory."

The effect of the new commodious and well-furnished building on the engineering instructors and students was very marked. For the first time the former had offices in which they could work undisturbed; and the latter had well-lighted and uncrowded drafting rooms and laboratories, and comfortable and stable drafting desks.

After the Department of Physics moved into its new building in 1909, the rooms it formerly occupied on the first floor as advanced laboratories were taken over as offices and recitation rooms by other departments. In 1916, the partitions between these rooms in the central wing were removed and the entire space in this wing was devoted to the Engineering Library.

The large room on second floor of the central wing was used for an engineering assembly and lecture room after the Department of Physics vacated it in 1909. In 1931 it, together with two small rooms on the west, was remodelled to become the upper floor of the Engineering Library.

1 University Catalogue, 1894-95, page 16.

As soon as the photograph and blueprint laboratory had been transferred to the Physics Building in 1910-11, the rooms thus vacated on the fourth floor of Engineering Hall were remodelled to accommodate the increased number of students in architecture and to provide another office for the faculty.[1]

The construction of this building, marked the first outward signs of the expansion of the College of Engineering. The old departments had outgrown their quarters in University Hall and the new departments were demanding a place in which they could set up in business, for engineering as a profession was developing rapidly, and the student enrollment was increasing and the size of the faculty growing in proportion. The engineers were the first to be honored with a separate major building for their own class room use; and while the recognition came none too soon, it did serve as a source of inspiration to faculty and students alike to carry on to greater achievement. For a number of years, the building housed the College offices and most of the rooms occupied by the several departments. Gradually, as the College grew, however, most of the departments, one by one, moved out into quarters of their own within the engineering group, leaving the building occupied at the present time by the College administrative and Engineering Experiment Station offices and by the Engineering Library and much of the Department of Civil Engineering.

Machine Tool Laboratory - The building known in 1945 as the Machine Tool Laboratory,[2] housing the present machine shop and heat-treatment laboratory, was erected in the fall of 1895 at a cost of about $23,000. It is a one-story brick structure 50 feet by 250 feet, located at the southeast corner of Burrill Avenue and Western Avenue, or what was originally the railroad tracks.

The 1895-96 issue of the University Catalogue gave substantially the following description:

---

1 It is a point of interest to note that the mosaics --the one in Room 302 making the name Farady and the one in Room 301 making the name Watt, were designed and executed by members of the staff of the Department of Architecture under the direction of Professor Newton A. Wells, in May, 1910

2 Called Machinery Hall from 1895 to 1897, Metal Shops from 1897 to 1921, The Machine and Forge Laboratory from 1921 to 1931, The Machine Laboratory from 1931 to 1938, and the Machine Tool Laboratory since 1938.

The name, Machinery Hall was applied to the building erected during the fall of 1895 which contained a lecture room, two office rooms, and the machine shop, forge shop, and foundry of the Mechanical Engineering Department. The machine shop, still in use, is 48 by 140 feet with the roof supported by steel trusses spaced ten feet on centers. Power was brought to the shop by a 30-horsepower rope drive from a Ball engine located in the Engineering Laboratory, originally called the Mechanical Building and Drill Hall, which stood where the Wood Shop and Foundry Building now stands. This method of drive existed from 1895, when the building opened, to 1898, when the Boneyard Central Power Plant was completed with its added power facilities. On one side of the machine shop was a jack shaft supported above the lower chord of the roof truss, and from this jack shaft, line shafts on either side were driven by belts on tight and loose pulleys. The turned line shafts, 2 1/4 inches in diameter and operating at 125 r.p.m., were supported by 18-inch self-oiling drop hangers fastened directly to the lower chord of the trusses. The line shaft on the north side extended through the foundry and forge shop, where the trusses were spaced twelve feet on centers. After 1898, a 20-horsepower electric motor was used to drive the shaft in the machine shop.

A three-ton traveling crane of 12-foot span covered the center of the floor for the entire length of the machine shop and extended over the driveway 10 feet wide at the east end of the shop, furnishing excellent facilities for loading or or unloading materials and machinery. The floor of the driveway was paved and was three feet below the floor of the machine shop.

The foundry came next to the machine shop, the floor being on the level of the driveway. A wing 18 feet by 24 feet extended north from the center of the foundry that contained a large and convenient core oven, a rattler, and a cupola. Castings weighing as much as 2,000 pounds were sometimes made here.

The forge shop adjoined the foundry, at the eastern end of the building.

<u>Electrical Engineering Building</u> - In 1897-98, a T-shaped, pressed-brick building, called the Mechanical and Electrical Engineering Laboratory, with a three - story front, 50 by 100 feet, and a one-story wing, 50 by 90 feet on the rear, was

erected at a cost of about $40,000 for the Departments of Mechanical and Electrical Engineering and also for the University electrical power plant and the automatic telephone exchange. The Department of Electrical Engineering occupied the space on the three floors of the front of the building, and the mechanical laboratory and the University lighting and power plant occupied the wing. The gallery across the west end of the steam-engine laboratory overlooked the electric plant.

The building was constructed throughout of solid brick walls upon brick footings laid in cement. The walls were faced on the outside with a dark brown flashed brick made by the Illinois Hydraulic Press Brick Company at Collinsville, Illinois. The black brick forming the diaper pattern in the frieze were made by the same company at St. Louis. The doorway and window trimming were terra cotta. The walls of the first or ground floor were lined with buff Roman brick laid in white mortar. The entire ground floor was cement. The floors above were supported upon steel girders and yellow-pine beams and constructed of three-inch yellow pine tongued and grooved mill flooring and seven-eighths inch finished flooring. The floors were capable of carrying 250 pounds a square foot. The entire upper story and roof trusses were supported by six steel trusses of the Fink type, the floor and partitions being suspended by two steel rods attached to each truss. The roof of the steam laboratory and power plant was supported upon eight exposed steel Fink trusses with horizontal chords. They carried a line shaft and a track for a four-ton travelling crane. The crane was arranged to run out at the east end of the building under the shed connecting the boiler house and laboratory, to facilitate the handling of heavy machinery. The opening left in the east wall for the passage of the crane was closed by a counterbalanced flap and two sliding doors.[1]

In 1905, the Department of Mechanical Engineering moved into its new laboratory building as mentioned elsewhere, and in 1910, the electrical generating units

1 The Technograph, Volume 12, 1897-98, page 41-43. Article by S. J. Temple, Asst. Professor of Architecture entitled "The Buildings of the Electrical and Mechanical Laboratory, and Central Heating Plant."

and the telephone exchange were moved into the University Power House, thus leaving this entire building for the use of the Department of Electrical Engineering.

The removal of these units from the one-story wing made it possible to permit changes in the building arrangement. The old power-plant room was divided into two large lecture rooms, two recitation rooms, and one large room to be used as a high-tension laboratory in which were installed the high-tension transformer and other apparatus connected with this line of work.[1]

This removal of the classroom from the upper floor of the building permitted an increase in the number of offices and a consequent increase in the efficiency of those occupying them. The old Electrical Engineering Society reading room was converted into a stenographer's office. A small room adjoining this was used as a seminar or library. To the Electrical Engineering Society was given the large general office which they equipped with furniture and pictures and made into a very pleasant lounging and magazine reading room.

At each end of the building large rooms were set aside as graduate studies, fitted with desks and other necessary furniture, where the students in the graduate school did a large part of their work. The stairs were moved into the center of the building leaving room for an office on the upper floor and a concrete floor space below on which were installed the new motor-generator sets. The office formerly occupied by the Superintendent of Buildings was converted into an instrument and reports room, and the room on the ground floor known as the calibration room, was thus left entirely for research work. In one corner of this room a dark room was built for the photographic work in connection with the oscillograph.

In 1929, this entire structure was remodeled and joined by a corridor across the boneyard to the building formerly occupied as laboratories by the Department of Theoretical and Applied Mechanics, as also mentioned elsewhere, and the combined structure has been occupied sine then by the Department of Electrical

---

1 This paragraph and the two following were taken from an article entitled "Changes in the Electrical Engineering Lab", by L. V. James, Instructor in E.E., The Technograph, December 1911, pages 33-34.

Engineering for office and laboratory purposes.

Electrical Engineering Annex - The building that since 1932 has been known as the Electrical Engineering Annex was erected in 1897 to house the boilers of the second central heating, light, and power plant which was located immediately north of the Boneyard and which is described in this publication as the Boneyard Power Plant. This 55-foot by 120-foot brick structure, is described in some detail in Chapter XX under the section entitled "The Boneyard Central Heating, Lighting, and Power Plant." This building was left vacant in 1910 when the power-house equipment was transferred to the new Mathews Avenue Station. A portion of the vacated structure was later taken for a University garage, and another portion was refitted in 1923-24 by the Department of Civil Engineering for a Cement and Concrete Laboratory. Still later another portion was remodeled and taken over by the Department of Theoretical and Applied Mechanics for a Fatigue-of Metals Laboratory. When these two departments transferred their equipment to the new Materials Testing Laboratory (later the Arthur Newell Talbot Laboratory), in 1929 the Department of Electrical Engineering adapted the space vacated by Civil Engineering to the use of a high-tension laboratory. A short time later, it remodeled the portion formerly used for fatigue-of-metals testing for an Illumination Laboratory and it extended this laboratory still later when the garage was moved to other quarters. Thus in 1932, the Department of Electrical Engineering occupied the entire structure using it for high-tension and illumination laboratories. The approximate cost of this building to date is $22,700.

Wood-Shop and Foundry Building - The brick building known as the Wood-Shop and Foundry[1] located at the southeast corner of Springfield and Burrill Avenues, was constructed in the form of a double H with the center portion two stories high. The main portion was built for a wood-shop in 1901-02,[2] on the site of the old building known by various names as Mechanical Building and Drill Hall, and

1 Called Wood-Shop from 1901 to 1904, Wood-Shop and Foundry from 1904 to 1921, The Pattern Laboratory and Foundry Laboratory from 1921 to 1931, and Wood-Shop and Foundry since 1931

2 Plans were provided by N.S.Spencer, Superintendent of Bldgs.& Grounds,1898-1902

finally the Wood-Shop and Testing Laboratory, which was burned in June, 1900, as previously stated. It contained the bench room, lathe room, machine room, lecture room, exhibition room, tool room, office, pattern-storage room, and repair work-room. Drying kilns and storage rooms were located in the basement. In 1904, a 35 by 80-foot addition was constructed at the eastern end for foundry purposes with a large molding floor traversed by a five-ton traveling crane, and with a large basement room for the storage of materials. The overall dimensions of the building are about 80 by 250 feet. The total cost of the structure was approximately $43,000 -- $31,000 for the wood-shop and $12,000 for the foundry.

The following detailed description under the title "The New Wood Shop" was furnished by Professor L. P. Breckenridge in The Technograph in 1901-02:[1]

"The new building was built of red brick, with sandstone trimmings. The building fronted for 70 feet on Burrill Avenue. The depth of the building was 198 feet.

"The lecture room had a seating capacity of 100. The wall at the end of the room was finished smooth and white for lantern projections. All speed and pattern-makers' lathes were grouped in a room by themselves. The machine room was at the rear end of the building. There was sufficient head room under the entire shop so that all shafting and belting was placed below the main floor. The second-story portion of the center was used for pattern storage, workshop for general University repair work, as well as for storage of dry lumber. The equipment in the shops cost about $600. The benches were each provided with six drawers with combination locks, and both side and tail quick-action vises.

* *

"Power was furnished by two electric induction motors -- one of 20 horse power and the other of 5 horse power. A combination blower and heater, located in the sub-basement, furnished warm air for a small dry kiln. The building was lighted by electricity and heated by steam, mostly by direct radiation, both the light and heat being furnished from the central plant of the University. The shop could handle 400 students. The first instruction in these shops was given by Mr. A. R. Curtiss on February 24, 1902."

<u>Laboratory of Applied Mechanics</u>[2] - In 1902, a two-story building 45 feet by 65 feet, facing west on Burrill Avenue immediately south of the Boneyard was erected as a materials testing laboratory known as the Laboratory of Applied Mechanics, and a two-story wing 46 feet by 115 feet was added to the rear, extending almost to the Water Works Building, for an Hydraulics Laboratory. The entire

1 Volume XVI, Pages 88-90
2 Plans were drawn by N. S. Spencer

building was constructed at a cost of $30,000, the outside walls being of buff-colored pressed brick, and the foundation of the main portion, red sandstone.

The materials testing laboratory was designed to house the testing machines and testing appliances, but there was nothing unusual about the form of construction.

In the hydraulic laboratory, the stand-pipe foundation rose to the level of the main floor. The floor opening in front of the stand-pipe gave light and communication between the two floors. Other openings in the floor allowed pipes to pass through. On the main or upper floor were placed weir tanks, orifice tanks, measuring tanks, motors, meters, and other similar apparatus. The line of pipe for determination of friction in pipes was placed along the north wall and on a balcony of the wall.

The basement or ground floor contained seven measuring pits, two weir chambers turbine pits, sump, and current-meter rating channel. These were built of concrete all connected with the sump and each other by a system of pipes under the floor, and also to waste pipes. One measuring pit was also arranged for work on a large scale with the jet meter. One weir chamber had a three-foot weir with end contractions, and the other a three-foot weir with suppressed end contractions. The current meter rating conduit was 100 feet long.

The floors, both above and below, were made of concrete, sloped to drain to the floor sumps having underdrainage. Space was provided for experimental work with plumbing devices, traps, siphonage, etc.

An office, computing room, brick testing room, and work-shop took up the remainder of the wing.[1]

As previously stated, in 1929, when the Department of Theoretical and Applied Mechanics moved into its new Materials Testing Laboratory, or Arthur Newell Laboratory, as it was afterwards called, this Laboratory of Applied Mechanics was remodeled, joined to the Electrical Engineering Building, and taken over by the Department of Electrical Engineering for laboratory purposes.

1 Technograph, 1901-02, Volume 16, Pages 83-84, from article "Laboratory of Applied Mechanics" by A. N. Talbot.

Civil Engineering Surveying Building - The Civil Engineering Surveying Building, a two-story brick structure trimmed with stone, erected in 1904-05 as the Horticultural Building, was taken over by the Department of Civil Engineering as a surveying building in 1923 and opened in September, 1924. It contains the instrument locker rooms and drafting rooms for the surveying courses and offices for some of the instructors teaching classes in surveying practice. Its location on the south campus where there is open space available for surveying purposes, offers many conveniences in the conduct of the surveying work. The cost of this structure to date is about $30,000.

Mechanical Engineering Laboratory - The Mechanical Engineering Laboratory, a brick building, the first unit of which was erected in 1905, originally had a frontage of 80 feet and a total depth of 182 feet. The front section, two stories high, contained the offices, lecture rooms, computing rooms, and a large instrument room. Back of this section were two bays with saw-tooth roof construction, each bay being 40 feet by 136 feet. The north bay was provided with a concrete testing floor and a 10-ton, 3-motor traveling crane of 38-foot span.[1] The cost of this construction was about $25,000.

In 1906, an addition 40 feet by 182 feet was constructed along the north side of the laboratory, similar in longitudinal section to the original structure --the one-story portion in the rear having been fitted with a 5-ton traveling crane. The eastern end of this portion was used by the Department of Civil Engineering for a cement and road-materials laboratory, the middle was used by the Department of Electrical Engineering for storage space for the electrical test car, and the west end was used by the Department of Theoretical and Applied Mechanics for a concrete testing laboratory. The cost of this addition was approximately $15,000.

In time, the laboratory building as constructed during 1905-06 became sufficiently inadequate to serve the needs of the Department as to warrant changes in the arrangement of the structure. Accordingly, following the removal from the north room to other quarters of the laboratory equipment belonging to the Departments of Civil Engineering, Electrical Engineering, and Theoretical and Applied

1 University Catalogue, 1904-05, page 46.

Mechanics, the work of remodeling the building began in the summer of 1916. The description that follows, taken from the The Technograph[1], gives a good idea of the arrangement that was provided then and which for the most part, exists today.

The brick wall separating the north room from the Mechanical Engineering laboratory was removed giving a clear available space of 120 by 140 feet. The old concrete floor was taken out of the laboratory and a basement four feet below the old floor level was excavated and concreted. Six feet above the old floor line, there was constructed a mezzanine floor, made of reinforced concrete 10 inches thick, supported by columns 18 inches square spaced at 15-foot intervals over the basement floor. This mezzanine floor was surfaced with granite chips giving it the resemblance of a terrazo floor. Two rows of light wells, each 7 ½ by 10 feet placed 15 feet on centers admitted daylight to the basement. No change was made in the three saw-tooth skylights which ran full length of the laboratory proper.

The south bay was arranged for heating and ventilating equipment, the north bay for steam equipment, and the middle bay for gas-engine equipment. At the west end of the middle bay on the street level, provision was made for an automobile-testing plant and a small gas producer.

In the basement[2] were constructed two large flumes each 4 feet deep and 4 feet wide running the full length of the laboratory to receive the water from condensers and cooling water from gas engines.

One large room adjoining the laboratory on the east was fitted with individual steel lockers, and with ample space for wash-room purposes. The laboratory tool and supply room was also located on the east end of the laboratory, with a checking system for handling tools and laboratory apparatus.

The work of reconstruction was completed in March,1917, although it took some time after that to make adjustments in equipment. The change added virtually a new story to the laboratory, and permitted a much more advantageous arrangement of the apparatus. The cost of making the change was approximately $40,000.

1 "The New Mechanical Engineering Laboratory", by V.S. Day '17, November,1917, pages 41-43.

2 The basement has a head room of between eight and nine feet and contains all of the condensers accommodating the engines.

During 1916-17, also, an addition, 20 feet by 40 feet, was erected at the southeast corner of the building as a continuation of the quarters originally occupied by the Department of Ceramic Engineering. This extension, providing for four offices and two research laboratories, was constructed at a cost of $5,000.

In 1923, when the addition (erected in 1910) on the southwest corner of the laboratory was vacated, the Department of Mechanical Engineering took over the space for shop, laboratory, and classroom use. This addition had housed the Department of Ceramic Engineering from 1910 to 1916, and the cement and highway laboratories of the Department of Civil Engineering from 1916 to 1923. The total cost of this building is now listed at about $91,000.

Physics Building - After several preliminary studies had been prepared by members of the Department of Physics and a student architect, final plans for the construction of the Physics Building were drawn by W. C. Zimmerman, an architect of Chicago. The contract for the construction of the building was let in July, 1908. The structure was completed the next year at a cost including furnishings of $250,000, and was formally dedicated on November 26 and 27, 1909 --the American Physical Society making this dedication the occasion for holding, in the new building, its Thanksgiving meeting of that year. Governor Charles S. Deneen was present at the dedication ceremonies and accepted the building for the State and presented it to the University. President James delivered the charge to Professor A. P. Carman, Head of the Department of Physics. Dr. Henry S. Pritchett, President of the Carnegie Foundation for the Advancement of Teaching, delivered the main address.

The building is a handsome four-story brick and fire-proof structure, trimmed with Bedford limestone. It has a length of 178 feet and a depth over its wings of 125 feet. The first floor is rectangular, the court space between the wings being used for the two large lecture rooms, both of which are lighted by skylights. The largest of these rooms has a seating capacity of 262, and the other, 120; and because of the numbers of students involved, it is important to have these rooms on the first floor. A one-story annex, 28 feet by 78 feet, contains the ventilating

and heating fans and the machine shop of the department. The foundations of the annex are independent of those of the main building. Practically all of the rotating power machinery is thus installed outside of the main building.

The total available space, exclusive of the basement, is about 60,000 square feet. The west wing contains three large, well-lighted laboratories and seven recitation rooms. The east wing is of heavy construction and contains twenty-one smaller laboratories for advanced experimental work. In addition, this wing contains the chemical rooms, a balance room, a special lecture room seating 50, photographic and photometer rooms, even-temperature rooms, and the usual cloak and rest rooms.

The elevator connecting the several floors from the unpacking room in the basement to the attic and also the apparatus stacks, originally was a direct-lift plunger. This type was chosen because of safety and because it required no rotating driving machinery. The elevator well was 6 feet square. In the summer of 1936, after this elevator was worn out, an electric lift was installed in its stead.

The apparatus stack extends through three stories and has mezzanine floors after the plan of library stacks. The storage capacity is thus practically doubled and the cases are accessible without the use of ladders. In addition to the elevator, there is a stairway in each stack.

Each laboratory is provided with one or more cabinets for apparatus for current use. The battery room in the basement is well-lighted and has a special ventilating fan.[1]

During 1939-41, at an expense of about $5,700, several minor changes were made in the building providing for some rearrangement of rooms for class and laboratory purposes and for some improvements in ventilating conditions.

Like all other buildings assigned to the College, the Physics Building has become overcrowded due to increased registration in courses, and the Department

1 The data for most of the description of the Physics Building ~~is~~ taken from an article entitled "The Laboratory of Physics", by A. P. Carman, The Technograph Volume 23, 1908-09, pages 40-46

has had difficulty in securing space adequate to carry on its instructional and experimental activities.

Transportation Building - The contract for the erection of the Transportation Building, a three-story structure, designed primarily for offices, classrooms and drafting rooms of the Department of Railway Engineering, was signed on May 17, 1912. This fire-proof building, constructed of brick trimmed with Bedford limestone and erected at a cost of $86,000, was open for work at registration time on September 16-17, 1912,--the Department of Railway Engineering having been assigned to the whole of the first floor, the Department of Mining Engineering temporarily to the second floor, and the Department of General Engineering Drawing temporarily to the third floor. The structure was formally dedicated on May 8 and 9, 1913, with addresses by Samuel Insul, President of the Commonwealth Edison Company of Chicago, and other prominent men in the railway and other utilities fields. A railway and mining show or open-house was held in connection with the dedication exercises.

This building, the first to be erected upon the land purchased between Mathews and Goodwin Avenues and lying between the Boneyard and the street car tracks, faces west on Mathews Avenue. At the time of the construction of the main portion of this building, the University had not obtained possession of all of the ground required for the completion of the north end. Consequently, the north 45 feet of the building was not finished until 1921. As finally constructed, the building is 65 feet by 193 feet, and represents a total cost of approximately $168,000. The first and second floors of the new part were occupied at once by the Department of Mechanical Engineering with recitation and drafting rooms, while the third floor was taken over by the Department of General Engineering Drawing for Drafting rooms. In the fall of 1928 the basement was occupied as an electrical shop by the Physical Plant Department.

Locomotive Testing Laboratory - In 1912-13, there was constructed a one-story brick and fire-proof structure, 43 feet by 117 feet in plan and 22 feet in height under the roof trusses, at a cost of $25,000, to house the locomotive testing plant, described elsewhere in this publication. A basement with a 6-ft. 9-in.

clear depth extends through all except 22 feet of its entire length. The building is well-lighted, the windows extending almost full height of the walls and occupying almost two-thirds of the wall area. All portions of the building except the space occupied by the coal room in the rear are served by a 10-ton traveling crane.

The building faces east towards Goodwin Avenue and is adjacent to the street car and interurban tracks of the Illinois Traction System, later known as the Illinois Terminal Railroad, on the north. It is set slightly on an angle to afford a better spur connection with these tracks in order to expedite locomotive movements. Originally connected with this building by a transite smoke-duct, was a concrete cinder-separator supporting a smoke-stack 81 feet high. In front of the building on the Goodwin Avenue end is a concrete reservoir constructed in 1914 for storing and cooling the water used in the operation of the testing plant. The total cost of the building and reservoir was about $34,000.[1]

Ceramics Buildings - In 1910, a two-story, 32-foot by 90-foot addition to the Mechanical Engineering Laboratory, was constructed for the Department of Ceramics at a cost of nearly $42,000. During 1915-16, however, there was erected primarily for the Department of Ceramic Engineering, after it became a part of the College of Engineering, a three-story (and basement) fire-proof structure 67 feet by 189 feet, of beautiful design of texture brick and polychrome terra cotta, at a total cost of $121,000. The cornerstone of the building was laid on September 28,1915, and the building itself was formally dedicated on December 6-7, 1916.

The face of the building is towards Goodwin Avenue and is decorated with colored-tile panels, making it one of the most ornate buildings on the campus. The roof is of Spanish tile and the floors of the halls and corridors of clay tile. The exterior and much of the interior finish is of terra cotta of various colors, demonstrating the advantages of the use of ceramic materials for structural and decorative purposes.

The present Ceramics Building has housed not only the Department of Ceramic

1 After the building was discontinued for locomotive laboratory purposes in 1943, the smoke-duct, cinder-separator, and smoke-stack were taken down during 1943-44. In November, 1944, the building was assigned for instruction in aeronautical engineering and was renamed the Aeronautical Engineering Laboratory.

Engineering, but also other departments as well. For a number of years, the Department of Theoretical and Applied Mechanics used portions of the first floor and the basement for a concrete research laboratory, having a 300,000-pound beam-testing machine located there which it used extensively in research work on concrete and on stresses in railroad track. This equipment was later moved into the new Materials Testing Laboratory as soon as it was completed in 1929. For a number of years, too, the State Geological Survey occupied the major portion of the third floor for office and workroom space. The Survey moved into the Natural Resources Building on the south campus when the building was completed in 1940, after which the Department of Mining and Metallurgical Engineering moved its departmental and other offices from the Transportation Building to occupy the space thus vacated in the Ceramics Building.

Mining and Metallurgical Laboratory - The building designated as the Mining Laboratory and Ceramics Kiln House, an L-shaped, one-story brick structure located immediately east of the Transportation Building, was completed late in the fall of 1912, at a total cost of $30,000, and was opened for instructional purposes at the beginning of the second semester of 1912-13. The north wing, 44 feet by 105 feet, was used by the Department of Mining Engineering, now the Department of Mining and Metallurgical Engineering. The main room housed the coal-washing and ore-dressing laboratory and also the drills and explosives laboratory. Another room contained the chemical laboratory, and still another, the mine-rescue station. In 1918, a small machine shop was added for the use of a mechanician in the Department, and in April, 1941, the Board of Trustees made an appropriation of about $6,000 for reconstructing the mineral-dressing laboratories. This remodeling was begun in February, 1942, and was completed within about a year's time. The change permits an increased efficiency in administering the laboratory work in the mineral-dressing and mining courses.

In 1935, a special appropriation of $50,000 was made by the General Assembly for the construction of an addition to the original Mining Laboratory. Ground was broken for the addition on May 6, 1936, and the structure was ready for

occupancy at the opening of the school year in September following. Class work was begun the first semester, but laboratory work did not get under way until the second semester. The building is a two-story brick and fire-proof structure, 42 feet by 100 feet, located at the east side of the Mining Laboratory, parallel to the Ceramics Laboratory described in the next paragraph. It is devoted entirely to class and laboratory work in metallurgical engineering.

Ceramics Laboratory - The greater portion of the south wing of the building originally designated as the Mining Laboratory and Ceramics Kiln House, was taken over by the Department of Ceramic Engineering for a drying laboratory, for furnaces and kilns, and for grinding and molding machinery -- one small portion of this wing being used by the Department of Mining Engineering for its Chemical laboratory. This wing, 44 feet by 154 feet, was connected to the Ceramics Building by a corridor to facilitate operation. A 60-foot radial brick chimney was constructed near the west end of the laboratory to accommodate the kilns.

Building for Architecture and Kindred Subjects - The Building for Architecture and Kindred Subjects, housing the Departments of Architecture and Art, is located on the south campus immediately west of the Commerce Building. The corner stone was laid on November 16, 1926, Professor Loredo Taft making the main address. The building was dedicated on November 8, 1928, President Kinley delivering the principal address on that occasion. The building was occupied at the beginning of the second semester of 1927-28, although much finishing and other work remained to be done during that semester.

The structure is T-shaped facing south, with the main entrance in the center of this front, and with the long axis east and west, and the stem extending north. The main portion of the building is 50 feet by 260 feet, while the north wing is 50 feet by 70 feet. The style of architecture is Georgian like the other buildings in its neighborhood. The elevation is red brick with Bedford limestone belt courses, trim, and cornices.

The building, a fire-proof structure, completed at a cost of about $485,000,

is three stories high with a basement and attic in addition. The west end of the basement is open through the first floor level to provide space for the Hall of Casts. The east end of the basement is used by the Architectural Club for its meetings and other purposes. The north wing or stem of the basement contains a modeling room 40 feet by 50 feet and a room for filing blueprints of important buildings erected in this country.

An exhibition room for paintings and drawings is provided on the east end of the first or main floor, and a lecture room occupies the north side of the north wing. The middle portion of this floor is occupied by offices. The north wing on the second floor is occupied by the Ricker Library. At each end of the front part, on each side of the Library, are large drawing rooms. With this arrangement, books can be taken from the Library and used at any point on this floor without being charged out according to the usual process. A large drawing room occupies each end of the third floor with classrooms and offices between. The top floor is devoted to studios for students taking freehand drawing, water-color, and other similar subjects.

<u>Arthur Newell Talbot Laboratory</u> - Construction on the Arthur Newell Talbot Laboratory formerly called the Materials Testing Laboratory, a four-story brick and fire-proof building of modified Georgian design, was begun in the fall of 1928. The corner stone was laid on October 25, 1928, with appropriate ceremonies including addresses by Dean Milo Smith Ketchum and by Professor Arthur Newell Talbot. The building was completed in the summer of 1929, at a cost of about $437,000, and was formally dedicated on May 2 and 3, 1930, when Robert Ernest Doherty, '09, President of Carnegie Institute of Technology, gave the principal address.

The building is located between Wright Street and Burrill Avenue a short distance north of the Boneyard. It has a structural steel frame, reinforced concrete floors, and partition walls of Haydite concrete blocks. It is constructed in the form of an H with the two wings measuring 50 feet by 187 feet, and the stem, 92 feet by 110 feet, making the over-all demensions of the building 187 feet

by 212 feet. The structure has a large central bay, 40 feet by 150 feet, open from the ground floor to the roof, served by a 3-motor, 10-ton traveling crane operated by electric power -- the distance from the floor to the under side of the crane being 50 feet. The main or second floor extends over the bay opening a short distance on the north side and the two ends to form a balcony. The second, ~~and~~ third, and fourth floors are entirely shut off from the bay except for casement windows in the corridors of these floors. A section of the floor of this crane bay is a slab of reinforced concrete 16 inches thick, 120 feet long, and 24 feet wide. In two directions at intervals of 6 feet on centers of the slab, 80 anchors were cast into the concrete, each anchor capable of resisting a pull of 50,000 pounds.

Adjoining the large crane bay on the south is a smaller bay 112 feet by 24 feet, with a height of 25 feet from the floor to the bottom of the 6-ton traveling crane -- the crane formerly used in the concrete laboratory in the present Ceramics Building. In the floor of this bay is another slab having anchorages along the center capable of resisting a pull of 10,000 pounds. These anchors are placed at 3-foot intervals on rows 4 feet apart.

The building is occupied by the offices, classrooms, and laboratories of the Department of Theoretical and Applied Mechanics. It is used, also, for the cement, soils, bituminous, non-bituminous, and concrete-research laboratories of the Department of Civil Engineering.

At a special convocation held in the University Auditorium on April 21, 1938, the building was renamed by the Board of Trustees in honor of the outstanding work done by Professor Arthur Newell Talbot in the fields of civil engineering and mechanics, as the "Arthur Newell Talbot Laboratory."

<u>Nuclear Radiations Laboratory</u> - In 1931-32, a one-story brick building was erected immediately south of the Boneyard on the west side of Goodwin Avenue as a laboratory and storage garage for the State Geological Survey. When the Survey vacated the property in 1940, the interior of the building was remodeled at an expense of about $5,300 and the building was taken over by the Department of

Physics for a Nuclear Radiations Laboratory to house the new cyclotron. The total cost of this building as it now stands is listed at about $37,000.

Sanitary Engineering Laboratory - The Sanitary Engineering Laboratory, designed to provide for instructional and experimental work in sewage treatment, water purification, and sanitation, is a red-brick building, with a three-story, 28 by 40-foot central portion, a one-story, 26 by 53-foot wing on the south, and a one-story, 14-foot wing on the north, that was erected between March and September, 1943, on the University grounds east of Goodwin Avenue and between the Boneyard and Western Avenue, Urbana, at a cost of about $40,000. The central portion of the building contains the tank room, which extends through the first and second floors, an office on the first floor, a student laboratory on the second floor, and a classroom on the third floor. Below the ground floor of this section is a channel for hydraulic experiments. The one-story wing on the north is used for a research laboratory and for graduate-student work, and that on the south, for a work room.

This building constructed by special appropriation in support of the war-training program, of World War II, was utilized to capacity in training enlisted men assigned to the University for special instruction in the field of sanitary engineering. The unusual facilities thereby made available here enabled trainees to secure a working knowledge of sanitary processes as applied to armed-service conditions that only a very few institutions in this country could supply.

Summary - All of the buildings north of Green Street that have ever been assigned to the College of Engineering for instructional and experimental purposes are still in use except the original Mechanical Engineering Shop Building, which was finally moved from the campus and remodeled for residential use, and the Mechanical Building and Drill Hall, which was destroyed by fire in 1900. Many changes have been made in these structures both inside and outside to meet the needs growing out of changing conditions. Even though one department was transferred from the College and two others were discontinued, the buildings have come to be crowded during the academic years on account of the enormous increase in

student enrollment and in the extensive expansion in research activities. Several of the buildings erected during the 1890's and the 1900's have become seriously outmoded, due to changes in industry and industrial development. There is urgent need for several new buildings constructed on modern lines to supply ample space for instructional and experimental purposes designed for present-day apparatus and in accordance with modern lighting and working conditions. In spite, though, of any handicaps that may have been due to building arrangements, the College has been wonderfully successful in its efforts throughout the years to carry on its educational-training and research programs, and to attain such achievements as have, no doubt, far surpassed any visualized objectives foreseen by those who were responsible for providing the funds for building construction.

CHAPTER VII

THE DEPARTMENT OF MECHANICAL ENGINEERING

A. ORGANIZATION

General - Although the report made by the Regent and the four Trustees in 1867, made provision for Mechanical Science and Art in the Polytechnic Department, it took a little time to get the department organized. Under officers and instructors and their titles as recorded in the 1868-69 issue of the University Catalogue and Circular, is listed the position of Professor of Mechanical Science. No one had been chosen to fill the position, evidently, for the name was left blank. The Department of Mechanical Engineering, or School of Mechanical Science, as it was originally known, was definitely established as a going concern, though, in January, 1870, with the appointment of S. W. Robinson as Professor of Mechanical Science and Engineering. Professor Robinson was the first man to be appointed to a chair in the College of Mechanics and Engineering; and it is interesting to note that he had the status of a full professor, although he had not quite attained the age of thirty-two.

B. OBJECTIVES AND METHODS OF INSTRUCTION

Objectives - The Catalogue and Circular of the Illinois Industrial University issued for the school year 1872-73,[1] contained the following statement regarding mechanical engineering:

"This school is intended to prepare students for the profession of Mechanical Engineering. It is designed to supply a class of men long needed, not simply practical nor wholly theoretical, who, guided by correct principles, shall be fully competent to invent, design, construct or manage machinery, in the various industrial pursuits. The instruction, while severely scientific, is thoroughly practical, aiming at a clear understanding and mastery of all mechanical principles and devices. Practice in the Mechanical Laboratory is combined with theoretical training and is counted as one of the studies of the course."

The Technograph in 1894-95 carried the following comment:

"The instruction was intended to give the student a thorough training in the fundamental principles underlying the science of machines and mechanisms, and thus enable him to become familiar with some of the numerous applications."[2]

A publication entitled "A Pictorial Description" issued by the College in 1919, contained the following item regarding the field of instruction in mechanical

1 Page 29
2 Page 180

engineering: "Mechanical engineering deals with problems connected with the generation and transmission of power, with the design, construction, operation and testing of machinery of all kinds, and with the application of power and machines to the varied requirements of modern industry."

Early Methods of Instruction - The Catalogue and Circular[1] for the school year 1872-73 bore the following paragraphs regarding instruction in mechanical engineering:

"Instruction in the school is given in both Principles and Practice."

"IN PRINCIPLES the knowledge is imparted by lectures, combined with the use of plates and illustrative models, and recitations are made from textbooks. Numerous examples are also given, showing the application of the theories and principles taught. Experiments in the testing of machines and motors are undertaken by the students.

"IN PRACTICE the instruction consists mainly in the execution of Projects, in which the student is required to construct machines, or parts thereof, of his own designing, and from his own working drawings. The students, in class exercises under competent teachers, use the machinery and tools of the Machine and Pattern Shop Foundry, according to the most approved methods of modern practice.

"The practical instruction is not intended merely to teach the trade, but is added as a necessary supplement to the theoretical training."

A publication[2] issued in 1878 contained the following statement regarding the instruction in Mechanical Engineering: "The instruction is intended to qualify young men for the designing, construction and management of machinery. The instruction is given by lectures in the absence of approved textbooks, enforced by numerous examples, illustrative plans and models."

During 1877-1881, the Professor of Mechanical Engineering taught all the subjects in Mechanical Engineering and all of Physics and resistance of materials as well.

C. ROOM ASSIGNMENTS FOR OFFICE, RECITATION, AND DRAFTING PURPOSES

General - When the Department of Mechanical Engineering was created in January, 1870, its first professor had his headquarters in Old University Building and when University Hall was completed in 1873, he, with others was transferred to that building. The Department occupied office, recitation, and drafting-room

1 Page 29
2 Announcement of the Illinois Industrial University Mechanic Art School Summer Session.

space there until Engineering Hall was finished in 1894. The space which it occupied in Engineering Hall was located in the east and west wings of the third floor, and consisted of an office, private studies for staff members, class rooms, drafting rooms, a cabinet room, and a seminary room. The drafting room was fitted with desks designed especially for the purpose by the Head of the Department of Mechanical Engineering. The desk contained drawers, drawing boards, and places for T-squares for four students. Two students could work at one desk at the same time. This type of desk was adopted by all of the other departments of the College except Architecture.[1]

In 1909, the department offices were moved to a suite of rooms on the first floor near the east entrance of the Mechanical Engineering Laboratory,[2] and in 1920, they were transferred to space on the second floor of the southeast corner of the building, where they have remained to date. When the north end of the Transportation Building was extended in 1921, the Department took over the first and second floors of the extension for offices, class rooms, and drafting rooms. In the fall of 1941, after the Department of Mining and Metallurgical Engineering had moved from the second floor of the Transportation Building, the Department of Mechanical Engineering utilized the space thus vacated for offices for some of its instructors.

Thus in 1945, the Department uses all of the space in the Mechanical Engineering Laboratory and a large portion of the first and second floors of the Transportation Building.

D. EARLY CLASSROOM AND DRAWING ROOM EQUIPMENT

General - The University Catalogue of 1894-95[3] carried the following statement regarding equipment of the Department of Mechanical Engineering:

"The equipment of the department is arranged for work under three heads - class and drawing room work, mechanical laboratory, and shop practice. Engineering Hall now being completed, the facilities for class and drawing work are unexcelled. The drawing rooms are equipped with modern desks, drawing boards, filing cabinets, card indexes, reference books, catalogues, odontographs, gear charts

1 The Technograph, 1894-95, page 180.
2 Now numbered 104 and 105.
3 Page 50

tables, etc. Provision is made in the cabinet rooms for the exhibition of kinematic models of Reulaux and Schroeder, machine models, specimens of defective boiler plate, and also sectioned steam specialties, many of them donated by the manufacturers."

E. DEVELOPMENT OF MECHANICAL ENGINEERING LABORATORY FACILITIES

A. POWER LABORATORY

Mechanical Laboratory Facilities, 1867-1893 - In connection with his early laboratory work in steam engines, Stillman Williams Robinson, the first professor in Mechanical Engineering, and his students took indicator diagrams of the 35-horse power steam engine which was built by students in shop practice during 1870-71 to furnish power for the shops. The Catalogue and Circular of 1872-73[1] stated in this connection: "Experiments in the testing of Prime Movers and other machines, are undertaken by the classes. They will take Indicator cards from the engine[2] of the Mechanical Laboratory[3] and determine from them the power developed with different degrees of expansion." Steam was furnished to the engine by the 33-horsepower Root patent boiler which had been installed in the boiler room of the building in the fall of 1871 as soon as the structure was completed. This boiler was used, also, for conducting other exercises in laboratory practice.

The work done by Professor Robinson, considering the appliances available, the number of students, the extent of his other duties, was very highly creditable. Little was done along this line of laboratory work, though, after he left the University in 1878 until about 1890. By that time the University had begun to accumulate some equipment that offered opportunities for more elaborate practice for students interested in this particular field.

By 1892, the University had acquired several boilers used for heating and power purposes.[4] The 32 by 36-foot boiler room of Machinery Hall (originally called

1 Page 30
2 A 10-horsepower steam engine had already been built here in the first three months of 1870, but this statement, no doubt, refers to the second engine.
3 In Mechanical Building and Drill Hall.
4 The original blacksmith shop annex, remodeled in the summer of 1890 for a boiler room, one of the boilers being placed in October of that year, and the other in March, 1892. These boilers were used to heat Machinery Hall and the Armory and to provide power for the shops.

Mechanical Building and Drill Hall) contained two 33-horsepower horizontal tubular boilers which could be used separately or together. It also contained necessary pumps, tanks, weighing apparatus, calorimeters, and other appliances for making complete tests of the economy and capacity of boilers.

In regard to steam engines, The Technograph of 1891-92 stated that the department had a 30-horsepower engine[1] fitted with indicators, friction brakes, and transmission dynamometers suitable for carrying on a great variety of tests. The Catalogue of 1891-92 mentioned that there was a 50-horsepower high-speed engine, made in the machine shop by students in Mechanical Engineering, and that this engine furnished power for the machine shop, and was available for testing purposes[2]. In addition, there were two steam engines and a gas engine belonging to the Department of Physics on the ground floor of University Hall that could be utilized for making tests.

The Catalogue of 1893-94 stated that the University had six boilers of different makes that were used for heating purposes and that could be used by the students of the department for observation and testing.

<u>Mechanical Laboratory Facilities, 1893-1905</u> - When Professor Lester Paige Breckenridge came to the University in the fall of 1893 to become Head of the Department of Mechanical Engineering, he put new zest into mechanical-laboratory work. He gathered from the different buildings into two rooms on the ground floor of the Chemistry Building (now Harker Hall) the two small engines made by Professor Robinson, a pump, some tanks, scales, and a few small pieces of apparatus, and started mechanical-engineering practice with one senior mechanical-engineering student.

The Catalogue of 1894-95 contained the following statement in this

2 This was a 10-inch by 12-inch Ball engine. The Ball Engine Company furnished the castings and the students of the class of 1892 finished and assembled them during 1889-91. The engine was rated in different descriptions from 25 to 50 horsepower. The old Robinson engine was retained and used for experimental work.

1 This was, no doubt, the 35-horsepower engine built by Professor Robinson and his students about 1871. It was all made here except the flywheel. The original cost was $760, but later improvements made within a year or so brought the total to $1,000. This is the second engine built here.

connection:

"The laboratory is now situated in the basement of the Chemistry Laboratory. It contains engines, boilers, pumps, surface condenser, and a large assortment of indicators, gauges, scales, thermometers, dynamometers, calorimeters, reducing motions, planimeters, measuring tanks, and apparatus for the calibration of instruments. It is supplied with steam from the central boiler house through a 5-inch main, and steam may be used from this source or from boilers in the laboratory itself. The engines may be run either with or without a condenser, with plain slide or expansion valves, or with automatic or throttle governors.

"Water is brought to the laboratory through a 2-inch main, furnishing a supply for condensers and boiler feed.

"The heating and power plant of the University contains eight boilers, two Root, one Sterling, three horizontal tubular, and two Babcock & Wilcox, aggregating eight hundred horse power. These furnish additional opportunity for experiment. Tests are also made in the power plants, pumping station, and factories of the two cities."

In the latter part of 1895, the laboratory equipment was transferred from the Chemistry Building to the Mechanical Building and Drill Hall.

The building known as the Mechanical and Electrical Engineering Laboratory (now the northern portion of the Electrical Engineering Building) was completed in 1897-98 and during 1898 the mechanical-engineering equipment was moved to the east wing of this new structure, and some new apparatus was added. At that time, there were six experimental steam engines available for instructional purposes connected by two independent mains to the near-by boiler house. These included one 10-horsepower Robinson engine, one 35-horsepower Robinson engine, one 35-horsepower Ball engine,[1] one 30-horsepower Meyer automatic engine, one 8-horsepower Sturtevant engine, and one 8-horsepower Nagle engine. There were, in addition, a 10-horsepower Otto gas engine, a 10-horsepower Atkinson-cycle[2] gas engine, a 2-horsepower Rider-Ericson hot-air Engine, that was used to illustrate the exterior-furnace type of motor, an Ingersoll air compressor and air-storage tank, five steam pumps, one pulsometer, numerous steam specialties, and a large assortment of the usual instruments arranged for experimental testing. A four-ton traveling crane of 20-foot span covered the central floor space.

1 This is the engine that stood in the old Mechanical Building and Drill Hall and that was used to supply power through the rope drive to operate the equipment in the machine shop. Its power was given at various times as from 25 to 50 horsepower.

2 This engine was originally installed in the University Hall lighting plant and was later given to the Museum of Science and Industry, Chicago.

During the same year, also, the University lighting and power plant was installed in the same wing of this building immediately adjacent to the equipment described above. These facilities included one 60-horsepower "Ideal"[1] single-cylinder, high-speed engine, made by Ide and Son of Springfield, one 100-horsepower "Ideal" tandem compound engine, and one 50-horsepower Westinghouse "Junior" engine. These engines were supplied with high-pressure steam through independent mains from the boiler house, and were available for testing purposes.

When the boiler house of the University central heating system (Boneyard station) was completed at the end of 1897, a few of the old boilers and several new ones were installed for power and heating purposes then or shortly thereafter. These included one 110-horsepower horizontal tubular boiler, equipped with Brightman mechanical stoker; one 250-horsepower National Water Tube boiler, equipped with Murphy smokeless furnace and automatic stoker; and two 220-horsepower Babcock & Wilcox boilers, equipped with Roney mechanical stokers. A short time later, there was added one 150-horsepower Babcock and Wilcox special boiler carrying 275 pounds steam pressure, provided with a hand-fired furnace, and one 150-horsepower standard Babcock and Wilcox boiler, furnished with a chain-grate stoker. All of these boilers were supplied with the usual auxilliary apparatus, and were all available for laboratory testing purposes.

In addition to the University engines and boilers described above that could be used for laboratory work, the public-utility pumping station and power plants of Champaign and Urbana and the shops of the Peoria and Eastern and Illinois Central Railroads furnished additional opportunities for experimental practice.

Mechanical Laboratory Facilities, 1905-1917 - In 1905, the mechanical-engineering laboratory was moved from the building occupied, since 1898, jointly by the mechanical and electrical engineering laboratory, into a new building, 80 by 142 feet, erected for that purpose; and at that time or shortly thereafter, the Department added greatly to its equipment, so that within a few years, the College had for the first time a reasonably-equipped mechanical engineering laboratory.

1 Originally installed in the University Hall central lighting plant in 1892.

The laboratory was arranged for testing fuels and various types of steam boilers, steam engines, superheaters, economizers, furnaces, gas engines, air compressors, pumps, and other devices and machines employed by engineers in the generation and transmission of power. It was provided with a large assortment of various types of indicators, gauges, scales, thermometers, pyrometers, calorimeters, measuring tanks, etc. with arrangements for calibrating and standardizing them.

There were nine steam engines of various types and capacities, one of which was the Reliance Corliss engine obtained in 1905. This was a single-cylinder machine 12 by 24 inches, horizontal, non-condensing type, double eccentric side crank, manufactured by the Allis Chalmers Company. It was equipped with a variable speed governor giving a range from 20 to 130 r.p.m. Its steam-supply pressure was 145 pounds a square inch, and its rating was 100 horsepower at 100 r.p.m. This engine was provided with a brake and other suitable apparatus for student testing. Another was a 65-horsepower four-valve tandem compound engine, originally designed by two students, Zimmerman and Sayers, for a thesis, and erected in the University shops during 1905-06. Still another was a 10-inch by 10-inch, 60-horsepower, Ideal high-speed engine originally provided for the University Hall power plant, and used later in the Boneyard Power Plant. It had been rebuilt and a throttling governor added to the centrifugal shaft governor. The two were independent so that the engine could be operated with each governor, thereby permitting tests showing the relative economy of the different methods of governing with a wide range of loads. In addition, there were three types of gas engines, nine pumps, eight injectors, one pulsometer, one hot-air engine, and one large-volume fan. The laboratory contained, also, a compound air compressor described later, a liquid-air plant consisting of a Norwalk four-stage compressor, compressing up to 4,000 pounds per square inch, and a Hampson liquifier with a capacity of about seven pints of liquid air per hour.

Other equipment included a 210-horsepower Heine water-tube boiler provided with a Green chain-grate stoker, a Sturtevant economizer, and a 150-horsepower independently-fired Foster superheater which made possible the study of problems

relating to superheated steam. The arrangement of the plant was such that the flue gases could be drawn, when desired through the Sturtevant economizer located beside the boiler, and the boiler setting was so constructed that the chain-grate stoker could be readily replaced by a hand-fired grate or another stoker. All varieties of Illinois coal could be burned efficiently without the production of smoke.

The facilities included, also, a 15-horsepower De Laval steam turbine directly connected to a compound centrifugal pump, which could deliver 140 gallons of water per minute when operating against a head of 500 feet. The turbine wheel and small pump runner made 23,500 r.p.m., while the large pump runner made 2,350 r.p.m. The turbine was provided with condensing and non-condensing nozzles.

Other equipment included a six-stage, 60-horsepower Kerr steam turbine supplied with an absorption dynamometer and a 60-horsepower Wheeler surface condenser, a Worthington surface condenser having 362 square feet of cooling surface, and independent steam-driven vacuum and circulating pumps, all arranged for special investigations of condenser performance.

There was installed in 1905, in addition, a 60-horsepower suction gas producer built by the Otto Gas Engine Works, for supplying gas for internal-combustion engines and other purposes. The producer was adapted to burn anthracite pea coal, coke, or charcoal.

For use in connection with this gas producer, there was provided a 23-horsepower Otto gas engine which had a 10-inch cylinder and a 19-inch stroke. It was equipped with a compressed-air starting device, sparking generator, speed indicators, and a complete outfit of instruments used by the mechanical engineer for testing purposes.

Furthermore, a two-stage tandem cross-compound steam-driven, air compressor manufactured by the Ingersoll-Sergeant Drill Company, was installed in the laboratory in 1905. The steam cylinders were 12 and 22 inches in diameter with a 12-inch stroke, and the air cylinders were 12 ½ and 18 ½ inches in diameter with a 12-inch stroke. The machine had a capacity of 300 cubic feet of free air per

minute at a speed of 120 r.p.m. The delivery pressure was 100 pounds a square inch and the steam-supply pressure 125 pounds a square inch. In the early days, a vertical receiver 42 inches in diameter and 8 feet in height was provided for use with the compressor. This was replaced later, however, by a different form of tank.

In December, 1907, the Board of Trustees accepted a Sargent gas engine presented to the College of Engineering by Charles E. Sargent, M.E., '86. It was a 10-inch by 20-inch tandem, double-acting 60-horsepower machine, with enclosed frame, and with self-oiling devices that operated without the crank or discs dipping into the oil. The side shaft was driven by a Rites governor.

A 15-horsepower single-acting, 4-cycle Bogart gas engine arranged to operate on city gas, producer gas, and gasoline, was obtained also about that same time. It was unique in that it had an adjustable piston rod and cross-head. The adjustable piston rod provided different clearances of the engine and made possible comparisons of efficiency under the different operating conditions.

In the spring of 1912, there was added a steam engine equipped with a single cylinder, 8 by 18-inch horizontal type and a single eccentric releasing Corliss slide crank manufactured by the Murray Iron Works. The steam-supply pressure was 120 pounds a square inch. The rating at one-fourth cut-off was 29 horsepower at 100 r.p.m. This machine was provided with Prony brake, condenser, and such apparatus as was necessary for student testing in laboratory exercises.

Among the items of equipment procured in 1913, was a Fairbanks, Morse and Company direct-acting, tandem-compound, underwriters duplex pump. The steam cylinders were 8 by 12 by 12 inches, and the pump was 7 by 12 inches. The intake suction pipe was 6 inches in diameter and the discharge pipe was 5 inches. The rated capacity of the pump was 750 gallons per hour at 35 single strokes per minute against a head of 300 feet. The initial steam pressure was 120 pounds a square inch with atmosphere exhaust. The pump was set to draw water from a cistern through a "Lea" water recorder of the self-contained pressure type having a capacity of 200,000 pounds of water per hour. The recorder registered

automatically the flow of water by means of a V-shaped weir and an automatic recording device.

There was installed during 1912-13, a 7-inch by 10-inch left-hand and a 10-inch by 12-inch right-hand Chandler & Taylor balanced slide valve, throttling engine. The two engines were so arranged that either one could be operated as a simple engine or so that the two shafts could be coupled and the two engines run as a cross-compound engine, one cylinder taking the partially-expanded steam from the other. The engines were fitted with approved reducing motions and a new design of rope brake. The steam supply was 145 pounds a square inch and the rating, 40 horsepower at 210 r.p.m.

There was provided in 1913-14, a 25-horsepower Erie City Iron Works economy steam boiler, which was connected to an old 15-horsepower Atlas engine to form a complete plant. A small open feed-water heater, and feed pump and an injector were included in this outfit so that students in undertaking a study of the steam engine and boiler could find it possible to trace out the several transmissions of energy from the coal pile to the delivered mechanical or electrical energy.

A Peerless six-cylinder automobile engine rated at 70-brake horsepower, was obtained in 1914-15 for use in connection with the Engineering Experiment Station. It was connected to a Richards Type of hydraulic absorption dynamometer.

A 75-horsepower Smith gas producer was received and installed in 1917 for use in experimental work to determine the adaptability of Illinois coal to use in gas producers. This was removed some time later, however, because of difficulties involved in operation.

Steam Prime Movers, 1917-1945 - After the laboratory was reconstructed in 1917, three steam engines including the two Corliss machines--one made by the Allis Chalmers Company and the other by the Murray Iron Works--and the Chandler and Taylor machine, all of which were previously described and all of which are still in use in 1945, were installed on the upper floor for instructional purposes.

Another important item of equipment provided here consists of a seven-stage condensing steam turbine manufactured by the Terry Steam Turbine Company, that

was installed in the laboratory in 1923. It is provided with a constant-speed governor and a separate emergency trip governor driving a 100-kilowatt, 250-volt direct-current generator made by the Allis Chalmers Company, the drive being accomplished through herring-bone reducing gears. The driving, transmission, and driven units are all mounted on a single cast-iron base plate.

The turbine is rated at 100-kilowatt capacity (with six nozzles in use) at a speed of 3,565 r.p.m. at full load with steam pressure at 140 pounds a square inch. The rate of steam consumption varies from 33.8 pounds per kilowatt-hour at half load to 26.3 pounds at full load. The turbine has an overload capacity of 125 per cent of full-load rating for a period of two hours.

The generator delivers 400 amperes of current at 250 volts, at a speed of 1,200 r.p.m. and at a normal temperature of 40 to 45 degrees C. The efficiency of the generator ranges from 87.8 per cent at one-half load to 90.5 per cent at full load.

The turbine was torn down in 1924 in order to fit pressure gages and thermocouples to the different stages so that more accurate information could be obtained about the thermal properties and the behavior of the steam in the operation of this particular type of engine design.

The list of equipment includes, also, a 25-horsepower steam turbine made by the Westinghouse Electric and Manufacturing Company. It has a steam-supply pressure of 140 pounds a square inch and operates from 3,000 to 6,000 r.p.m. The turbine is connected to a 30-horsepower, 230-volt, Mid-West Dynamic dynamometer supplied with a Toledo scale. The equipment was procured from the Mid-West Dynamometer and Engineering Company in 1940.

In addition to individual brakes, all of the engines above mentioned are equipped with surface condensers and weighing tanks for collecting the steam--condensing and measuring it in order to determine the steam consumption during the period of the test. These condensers are all located on the lower floor immediately under their respective engines.

The experience which the students have gained from experiments carried on

with this equipment in the conduct of efficiency and other tests has enabled them to realize the relationships that exist between theory and practice in this particular type of power-plant operation, and has afforded some first-hand knowledge of the practical problems they will have to face in the design, construction, and operation of industrial plants employing that type of power.

Internal-Combustion Engines 1917-1945 - Because of the many applications of the internal-combustion engine to industrial use, a wide range of representative equipment of this type has been provided from time to time for instructional and and experimental purposes relating to engine design, fuels and fueling systems, cooling systems, lubricants, ignition, and economy. These are described in some detail in the following paragraphs.

The Bogart single-acting, four cycle illuminating gas or gasoline engine previously described, was installed on the main floor after the laboratory was rearranged for use in instructional and experimental service. The 70-horsepower Peerless six-cylinder automobile engine was also installed at that time. Both machines were later removed to make way for newer models.

An Hvid type of compression-ignition oil engine, manufactured by the Midwest Engine Company, was added to the laboratory equipment in 1921. It is a 10 5/8-inch by 18-inch, horizontal, single cylinder, four-stroke cycle, having a rating of 35-horsepower at 250 r.p.m. It can use kerosene or any other type of liquid fuel. The engine is started by a compressed-air starter using air from a storage tank -- the air being shut off when the motor begins to run. The machine is supplied with suitable brakes and other appliances for laboratory testing.

There was installed in 1923, a 12 by 21-inch, single-cylinder, four-cycle, single-acting, horizontal type of gas engine, manufactured by the Otto Gas Engine Works, designed to operate on either city or producer gas. Using city gas as fuel it can develop 50 horsepower at a rated speed of 230 r.p.m. The rating for the same speed when using producer gas is 40 horsepower, and when so operated, the engine is supplied from the 50-horsepower gas producer provided in the laboratory. The machine is equipped with a compressed-air starter and all accessories for

running tests including friction brakes.

The laboratory also contains a two-cylinder solid-injection, four-stroke cycle, Diesel engine 10 3/4-inch by 13 3/4-inch, manufactured by the Chicago Pneumatic Tool Company and installed in 1930. The manufacturer's rating is 80 horsepower at 327 r.p.m. The machine is also started by means of compressed air, and is supplied with brakes for testing purposes.

A four-cycle, 4 3/4-inch by 6 1/4-inch, marine Diesel engine complete with Bosch fuel ignition system, made by the Atlas-Imperial Diesel Engine Company and donated to the University by the manufacturer, was set up on the main floor of the laboratory in 1942. The engine operates at 950 r.p.m. and develops 18 brake horsepower. It is supplied with appropriate brakes and other facilities for making laboratory tests.

Among the Diesel engines, there is a four-cylinder, solid-injection, four-stroke, low-speed, Diesel-cycle engine of the tractor type built by the International Harvester Company and loaned to the Department in 1937. The manufacturer's rating is 62.8 horsepower at 1,250 r.p.m. Another installed in the same year is the six-cylinder, 3 ½ by 4 ½-inch, solid-injection, four-stroke, high-speed, Diesel cycle automotive engine, made by the Hercules Motor Corporation. The manufacturer's rating is 77 horsepower at 2,600 r.p.m. This was installed in 1937-38. In addition, there is a Chrysler Imperial, 1934 model, eight-cylinder, four-stroke, Otto cycle gasoline engine manufactured by the Chrysler Engineering Corporation. The manufacturer's rating is 120 horsepower at 3,400 r.p.m. This was given to the Department by the manufacturer in 1935. The equipment also includes a 1940 model, Royal 6 type, six-cylinder, four-stroke, Otto-cycle gasoline engine manufactured by the Chrysler Corporation and installed in 1940. The manufacturer's rating is 108 horsepower at 3,600 r.p.m. It includes, too, a 1940 model, eight-cylinder, four-stroke, Otto-cycle gasoline engine manufactured by the Ford Motor Company. The manufacturer's rating is 85 horsepower at 3,800 r.p.m. This was loaned by the Chicago Branch of the Ford Motor Company in 1939-40.

These five engines described above are arranged in the west end of the south

bay of the laboratory so that each machine can be attached to an absorption and transmission dynamometer of the electric generator type -- the dynamometer in use for this purpose in 1945 being the 150-horsepower, 250-volt, Sprague machine obtained by the Department in 1916.

The internal-combustion engine using various grades and types of fuel, has probably made greater strides in development than any other form of prime-mover power. Because of such rapid advancements, the University has had a difficult problem in attempting to keep abreast of such progress because of the heavy first cost of such equipment and the lack of space for proper housing and demonstration. Such facilities as it has been able to provide, though, have served to furnish excellent instruction to long lists of students and to supply data for the many bulletins issued by the Engineering Experiment Station.

Pumps, 1917-1945 - The several steam and electrically-driven pumps that have been installed at different times, have been devoted largely to instructional purposes. Among those installed since the laboratory was reconstructed in 1917, is the Fairbanks, Morse and Company machine described under a previous section. In the new installation, however, the pump takes water from one flume in the basement and returns it to another one through a V-shaped weir, and the use of the storage cistern has been discontinued. Another was the De Laval steam turbine-propelled centrifugal pump procured in 1905 and described in an earlier paragraph in this chapter. This, however, was taken out some time later.

There was provided on the lower floor of the laboratory in 1922-23 an American Well Works, Inc., 4-inch standard open impeller centrifugal pump, direct-connected to a Sprague cradeled type of dynamometer. This pump, removed some time ago, had a speed of about 1,200 r.p.m. The water discharged was measured by orifices in the bottom of a tank, the discharge pressure having been controlled by a hand-operated valve.

In 1927, the Department installed a 3-stage, single-suction, Cameron Centrifugal, boiler feed pump made by the Ingersoll-Rand Company. The rated capacity is 250 gallons per minute at 200 pounds per square inch gage pressure. The rated

speed is 2,000 r.p.m. The suction intake pipe is four inches and the discharge pipe is three inches in diameter. The water is measured by a Venturi meter and a V-notched weir in series. The pump is attached to a 230-volt, 75-horsepower, Sprague dynamometer procured from the General Electric Company in the same year.

Air Compressors 1917-1945 - After the laboratory was remodeled in 1917, the Ingersoll-Sargeant air-compressor, previously described, was installed in the middle bay of the main floor and is still in use there.

Another piece of equipment added to the laboratory in 1924-25, is a single-stage Worthington 8 ½-inch by 9-inch feathervalve air compressor made by the Worthington Pump and Machinery Corporation. It is operated by a Westinghouse 40-horsepower induction motor operating at 870 r.p.m. full load. The outfit is used to supply compressed air for starting the laboratory gas engines and for experimental purposes.

In 1938, there was installed on the lower floor of the laboratory a two-stage tandem 6-inch by 2 3/4-inch by 7-inch air compressor complete with equipment made by the Chicago Pneumatic Tool Company. The compressor, belt-driven, is operated by a Fairbanks, Morse & Company 20-horsepower motor. The plant has a capacity of 56 cubic feet of free air per minute at 350 r.p.m. The delivery pressure is 450 pounds a square inch.

Miscellaneous Equipment in Use in 1945 - Among the items of miscellaneous equipment which the Department has been able to provide is a Reeves variable-speed transmission apparatus mounted on a heavy cast-iron base, which was procured in 1925-26. In 1928, it installed a belt-testing set consisting of one 50-horsepower cradeled electric motor for power input and one 50-horsepower generator for absorbing the power transmitted by the belt. The equipment is used to study belt-tension and slippage and energy-transfer problems involved in the transmission of power by belt, rope, or chain drives.

Another piece of apparatus consists of an automotive brake-testing device, constructed and erected by the Department in 1926-28, for study of the action and efficiency of automotive brakes, the rate of deceleration, and the amount of

energy consumed in retarding a vehicle. The mechanism is operated by applying the brakes to a rotating shaft loaded in such manner as to accumulate a momentum equivalent to that of a moving car or truck.

Miscellaneous small equipment available for a variety of uses includes calorimeters, Orsatt apparatus, thermometers, pyrometers, gages, gas and steam-engine indicators, indicator springs, planimeters, tachometers, anemometers, Venturi meters, and so on.

B. HEATING, VENTILATING, AND AIR-CONDITIONING

General - The science of heating, ventilating, and air-conditioning is comparatively new. The problems that arise in this particular field involve the design, construction, installation, and operation of heating and heat-transfer systems and appliances, and cooling and air-conditioning apparatus used for domestic, commercial, and industrial purposes. The provisions that have been made here from time to time in supplying facilities for instructional and experimental uses are indicated in the descriptions that follow.

Heating Boilers - During 1907-09, the Department received two steam house-heating boilers -- one an American Radiator Company type and the other a Mercer. Each was provided with its own stack, load regulator, and complete auxilliary equipment for testing purposes.

In 1917-18, the Kewanee Boiler Company donated to the Department one of its standard tubular up-draft, steam-heating, brick-set boilers, and erected it in place in the south bay of the laboratory. The gift included also a stack for the boiler. The University supplied the brick work, but the company paid all of the other expenses.

In 1935-36, the Link Belt Company supplied as a gift to the University a mechanical stoker, No.52, for use in connection with this boiler. At that time, also, the Field Manufacturing Company supplied gratis a barometric draft control for use at the base of the boiler stack. The complete outfit is still in use in 1945.

A number of other smaller boilers located in the laboratory, are available

for instructional and experimental work in hand-fired and stoker-fired systems of household heating.

Warm-Air Furnace Testing Plant - For research purposes, a warm-air furnace testing plant was erected in the middle bay of the laboratory in 1917, consisting of a tower-like structure provided with three floor levels, the furnace occupying a space on the main floor level with the first, second and third floors above this level. The usual warm-air stacks were provided from the furnace jacket to each of the floor levels, permitting a study of the movements of air in these devices, thereby enabling the staff to determine with precision the conditions affecting the efficiency of hot-air systems.

Fan-Testing Plant - One section of the lower floor of the Mechanical Engineering Laboratory is arranged as a fan-testing plant in which have been installed eight or ten large-size blowers or fans of different types and makes equipped for testing according to the provisions of the American Society of Heating and Ventilating Engineers' Standard Code. These fans, driven mostly by electric motors of the dynamometer type, vary in capacity up to 5,000 cubic feet of air per minute. Air ducts or tunnels simulating those found in practice, serve as outlets to the fans. The rate of air movement in these ducts or pipes is measured by means of orifices, Pitot tubes, and other anemometer devices commonly used for flow-meter purposes.

Warm-Wall Test Booth - In 1931, a warm-wall test booth was set up on the main floor of the Mechanical Engineering Laboratory with construction featured in accordance with the specifications given in the American Society of Heating and Ventilating Engineers' Standard Code for Testing and Rating Concealed Gravity Type Radiation (Standard Code). The room, 12 feet by 13 feet 4 inches in plan and 9 feet in height, is supplied with several types of radiators, convectors, and enclosures for experimental work in steam and hot-water systems of heating, and with such auxilliary appliances as are necessary for reading and recording temperature, humidity, and heat losses.

Constant-Temperature Room[1] - In 1927, there was constructed in the south bay

1 The Technograph, March, 1927, page 140.

of the main floor of the laboratory, a constant-temperature room 16 by 27 by 16 feet. Within this main room were built two small rooms 9 by 11 by 9 feet each. Under and over each small room was located an air space of about 12 inches, which was also insulated from the larger room, thereby giving what resembled a small one-room house with basement and attic. These smaller rooms were used for conducting experiments, which required constant temperatures, for testing the heat-insulating properties of building materials. The floor of the larger room was laid on the concrete laboratory floor and was composed of two 3-inch layers of cork board and one 3-inch layer of concrete. The corkboard was made in blocks, 3 inches thick by 12 inches square. The two layers of cork were separated by a thin layer of asphalt, and the concrete was poured over the cork. The walls and ceiling of this larger room were made of the same materials, using three 2-inch layers of cork, separated by one-half inch of concrete mortar. One-half inch layer of cement plaster was laid on each side of the cork wall. This construction prevented loss of heat through the walls.

Thirteen thermo-couples were equally spaced in a horizontal position throughout the depth of the cork and concrete floor, at two sections of the large room. In this way the temperature gradient could be determined of the materials under test. By substituting these sections for sections of other materials, also equipped with thermocouples, conductivity of any type of building material can be determined.

At first, constant temperature was maintained by a thermostatically-controlled, single-cylinder, motor-driven, Worthington 4 ½-inch by 4 ½-inch, enclosed ammonia compression machine of about eight tons capacity, using a horizontal tube condenser wall radiation, with circulators much like the ordinary wall radiators, instead of the usual pipe circulators. In 1929, this compressor was taken out and a double-cylinder, 5-inch by 5-inch, motor-driven, York ammonia compressor of about twelve tons capacity, was installed in its stead, and is still in use for this purpose.

In 1938, the constant-temperature test plant was remodeled to the extent of

providing a single room 15 feet wide, 18 feet long, and 8 feet,6 inches high, in place of the two smaller rooms previously described -- the outside enclosing room remaining unchanged.

Air-Conditioning Plant - In 1936-37, the old Webster air washer, added to the laboratory equipment in 1914-15, and typical of the type used for purifying and humidifying air in hotels, theaters, factories, and other large buildings, and the Buffalo Forge hot-blast heater adjacent to it, were removed from the upper floor of the Mechanical Engineering Laboratory and in the space thus made available was erected the new all-year air-conditioning plant used for the study of air-conditioning in undergraduate and graduate courses and for experimentation in this particular field of engineering practice. The different units that comprise the plant are types of appliances used in actual construction of air-conditioning.. They are so arranged that all combinations of the various methods of treating air can be used. The overall length of this plant -- 42 feet, 8 inches -- is greater than in most commercial plants of its type and capacity because an attempt was made to incorporate into this assemblage as many different features as possible.

The equipment included Venturi sections for measuring the discharged air, recirculated air, and ventilating air; dry air filters of the pocket type and an air washer for cleaning the air, the air washer being also supplied with an indirect water heater; manual dampers for controlling the relative amounts of by-passed air, recirculated air, and ventilating air; extended surface steam tempering coil; humidifying mist nozzles; extended surface coils for cooling and dehumidifying with water; extended-surface direct-expansion Freon evaporator; direct expansion Freon water cooler; and a Freon condensing unit. The Frick Company, Inc. very generously made the University a gift of the 5 3/4-inch by 4-inch, twin cylinder, Standard Frick Freon compressor, complete with V-belts, grooved compressor wheels and motor pulley. This compressor when operating at a speed of 450 r.p.m., 38 degrees F. suction temperature, and 110 pounds condensing pressure, has a duty of 13.1 tons of refrigeration, and requires approximately 12.7 boiler horsepower.

The equipment has a capacity of 3,000 cubic feet per minute. The fan motor and compressor motor operate by 220-volt direct current with variable-speed control. The entire assembly was covered with a 2-inch thick corkboard insulation from the air filters to the throat of the Venturi section for measuring the discharged air. The contract for the equipment, including complete erection, testing etc., was awarded to the Midwest Engineering and Equipment Company of Chicago, who completed the assembling in the spring of 1937.

The operation of the equipment is fully automatic with Powers' controls with the exception of the manually-operated air dampers. Air cooling and dehumidification can be obtained by use of the air washer using chilled spray water, by use of chilled water in extended surface coils, and by direct expansion of Freon in an extended surface coil.

One of the most interesting of the features of the equipment is the method of determining the humidity of the air in the ducts. Throughout the unit, there are sets of wet-bulb and dry-bulb thermometers located at critical points. These thermocouples are connected to the main control board, the difference in wet-bulb temperature and dry-bulb temperature being determined at any actual point in the system. From this difference, the humidity of the air is easily determined.[1]

The apparatus is suitable for use in detailed studies of:

1. Air cleaning by use of either filters or washers.
2. Air humidification.
3. Air cooling and dehumidification by three different pieces of apparatus.
4. Hot-blast heating using either steam or hot water as a heating medium.
5. Heat transfer of finned coils using either steam or hot water as a heating medium.
6. Heat transfer of finned-tube cooling coils, using either chilled water or direct expansion of the refrigerant (Freon) with wet and dry surfaces.
7. Problems involving the reheating of cooled and dehumidified air by use of either a steam reheating coil or by by-passing recirculated air.
8. All-year air-conditioning of spaces in which typical load conditions may be maintained either in summer or winter.
9. Centrifugal fan performance under different load conditions.

1 The Technograph, December, 1937, page 9.

10. Precision measurements of both dry and wet bulb air temperatures.

11. Air distribution by means of nozzles, grills, diffusers, etc.

12. The measurement of air-flow and friction losses in ducts of varying section, and shape and different units such as filters and coils.

Warm-Air Heating Research Residence - During a special convention held at the University on December 4, 1923, the National Warm Air Heating and Ventilating Association made available a fund of $25,000 for the purchase of a lot and for the construction and equipment of a residence to be known as the Warm Air Heating Research Residence, for experimental use by the University in warm-air heating, ventilating, and air-conditioning studies. The site chosen for the residence was at 1108 West Stoughton Street, Urbana, about a block from the University campus. The house, a modern three-story frame structure containing eight rooms, was completed in the fall of 1924 at a cost of $22,800, and was dedicated on Tuesday, December 2, following -- the dedication services being held in the building itself. Title to the real estate is held in trust for the Association by three trustees, one of whom is a member of the Department of Mechanical Engineering at the University.

During construction and after, the building was elaborately equipped with both indicating and recording instruments for the measurement of temperatures, air quantities and velocities, humidity, wind movement and direction, fuel consumption and waste. The house was furnished with regular living facilities so that the conditions prevailing in actual residences would be duplicated in so far as possible.

I-B-R Research Home - In April, 1940, the Institute of Boiler and Radiator Manufacturers signed a contract with the University, effective as of January 2, 1940, providing the sum of $24,000 for erecting and equipping a Research Residence and for conducting research on steam and hot-water systems of heating. A lot located at the southwest corner of Green and Busey Streets in Urbana, was purchased with the funds, and plans and specifications were drawn by J. E. Stewart, Associate in Architecture in the University. Construction was started in May,

1940, the building being a typical two-story, red-brick veneer on a frame structure with an attached garage, and representing houses between the $6,000 and $7,000 class. All of the outside walls and the second floor ceiling are insulated with full-thickness mineral wool bats.

During the time of construction, all necessary thermocouples, moisture-measuring stations, and other facilities for the study of the thermal and physical properties of the house structure were built into the walls. The house was completed and all furniture and instruments were installed by the latter part of the year. All necessary equipment for the study of the atmospheric and environmental conditions within the rooms effecting human comfort as well as for the operating characteristics of the heating plant itself were installed. Experimental work was begun about the first of January, 1941.

C. MECHANICAL REFRIGERATION

General - In 1905, the Department installed in the new Mechanical Engineering Laboratory a vertical, twin-cylinder, ammonia compresser, with single-acting, open-frame, horizontal Corliss type of steam engine, made by the York Manufacturing Company. This plant was completely overhauled in 1920-21, when new cylinders were provided and the entire machine was taken down, inspected, and carefully adjusted for proper operation. This equipment, still in use in 1945, has a refrigerating capacity of about 10 tons at 84 r.p.m. The intake pressure is 20 pounds a square inch at the gage and delivery pressure is 165 pounds at the gage. The steam-supply pressure is 150 pounds a square inch.

In 1920, the Department installed a 10-ton ammonia absorption refrigerating plant purchased from the Henry Vogt Machine Company of Louisville,Kentucky. This plant was dismanteled about 1941. For use in research work, the Automatic Carbonic Machine Company of Peoria, loaned the Department a 10-ton carbon dioxide compressor, condenser, and auxilliary apparatus, which was set up during 1922-24. This plant was also dismanteled a few years ago.

For demonstration purposes, the General Household Utilities Company, in 1935, provided the Department with a William C.Grunow household-type of refrigerator

unit complete, but without the enclosing case. The Freon refrigeration unit installed in 1937, in connection with the special experimental air conditioning plant, is also available for studies in the field of refrigeration.

The single-cylinder Worthington ammonia compressor that was formerly used in connection with the constant-temperature room, and the double-cylinder York machine that is now used for that purpose, are both available for instructional and experimental work in the field of mechanical refrigeration.

It is apparent from the above descriptions, that throughout the years, the Department has been rather reasonably well supplied with facilities for conducting classroom, laboratory, and experimental work with various types of refrigerating systems used in space-cooling, cold-storage, and ice-production, as a means of demonstrating the economic and commercial applications of refrigeration to domestic and industrial purposes.

D. THERMODYNAMICS

General - Since the opening of the University, a limited number of engines and boilers of various types and makes have been available for study and demonstration of the principles and laws governing the behavior of liquids, gases, and vapors when subjected to applications of heat. In 1939-40, however, there was begun the development of a new special or separate thermodynamics laboratory in which undergraduate students, graduate students, and members of the faculty could carry on research in the field of thermodynamics -- a subject pertaining to the study of heat and the application of its mechanical power to machines of production operated by steam or by gas, oils, and other liquid fuels. The laboratory was first located in Room 112 of the Mechanical Laboratory Building, but in the summer of 1940, it was transferred to Room 101 of the same building. The equipment consists of apparatus for making accurate determinations of temperature and the rate and volume of flow of liquids, gases, and vapors used in heat engines; of investigations of heat transfer by conduction, radiation, and convection; and of calibration or standardization of instruments used in thermodynamic experiments. The apparatus includes various makes and types of pyrometers and calorimeters;

Venturi meters, Pitot tubes, orifices, and nozzles; and facilities for standardizing instruments used in investigational work in the field of thermodynamics.

In addition to providing original instruction for students regarding the properties of heat and heat engines, the equipment has served to supply a vast amount of data that have been useful in the publication of several bulletins by the Engineering Experiment Station and a number of textbooks by members of the staff that have been considered to be valuable contributions to the literature in this particular field. Goodenough's "Principles of Thermodynamics" and his "Properties of Steam and Ammonia", for example, have long been standard texts for the solution of problems in the domain of thermodynamics.

E. RAILWAY TRACK AND ROLLING STOCK

Dynamometer Car, or Railway Test Car, No.609 - In addition to the laboratory facilities of its own just described, the University had an interest in a considerable amount of apparatus designed for use in locomotive road tests. On June 6, 1898, the Department of Mechanical Engineering received joint ownership with the Peoria and Eastern Division of the Big Four Railway of the fully-equipped dynamometer car, No.609, built in the Urbana shops of that line and installed under the direction of members of the Department. The equipment in this car was designed and constructed for locomotive and other railway tests under actual service conditions, and was used for no other purpose. It had sleeping accomodations for four men. Brief mention was made of this outfit in The Technograph of 1898-99[1] as follows:

"It is designed with special reference to the following service:

1. To secure greater convenience in making locomotive road tests.
2. To provide an automatic apparatus for recording pull at the draw-bar of the tender.
3. To permit the inspection of the track for gage, alignment, surface, joints, and elevation of curves.
4. To determine train resistance.
5. To test the operation of air brakos in service.

1 Volume XIII, pages 40-47, by W. W. Webster, '99, and H. M. Ely, '99.

6. To test stationary plants.

"For this purpose a caboose was rebuilt, being mounted on four-wheeled passenger trucks, equipped with M.C.B. couplers and Westinghouse air brakes. The car was 36 feet long and weighed about 36,000 pounds.

"The speed of the train during the tests was measured by a Boyer speed recorder driven from the car axle by a wire belt.

"The following records were made: boiler pressure, steam chest and air pressures, revolutions of the driving wheels, amount of water furnished to the boiler (by meter), position of the reversing lever, time of passing mile posts, time of taking indicator cards, and a continuous record of the pull of the train."

The car was sold about 1902-03, for the University was not able to justify the maintenance of two cars of this type, since it had only recently acquired the one described in the following section.

Dynamometer Car, or Railway Test Car No.17 - To facilitate the work in railway mechanical engineering, the University and the Illinois Central Railroad in 1900 jointly built, under the direction of members of the staff of the Department of Mechanical Engineering, a dynamometer car which was equipped with all the apparatus necessary for carrying on track inspection, train-resistance experiments, and tests of locomotive performance. In the six-year period from 1900 to 1906, this car was operated by the students and instructors over the entire Illinois Central Railway System, as well as on portions of the lines of the New Jersey Central, the Baltimore and Ohio, the Cleveland, Cincinnati, Chicago and St.Louis, and the New York Central railways, in the successful and satisfactory establishment of tonnage ratings under different service situations. The car had also been used in determining train resistances under varying conditions to provide information for the electrification of the New York Central Railway's New York City terminal, and in tests between steam locomotives and electric motor-cars at the works of the General Electric Company, at Schenectady, New York.

When the Department of Railway Engineering was established in 1906, the car was transferred to that department, where it remained, although mechanically changed and renumbered, until the Department was dissolved in 1940. The car was then assigned to the Department of Electrical Engineering.[1]

1 Further description given in Chapter XV.

F. DEVELOPMENT OF SHOP LABORATORY FACILITIES

First Mechanical Engineering Shops - The Catalogue and Circular of 1869-70,[1] issued after the second story had been added to the first Mechanical Engineering Shop Building contained the following description of this shop:

"A mechanical shop, occupying a two-story (wooden) building, is now established on the grounds of the University. In the upper story is the carpenter's shop. This shop is supplied with a circular-saw, jig-saw, morticing machine, and a set of work benches and vises for students, with all the necessary carpenter's and cabinet-maker's tools. The lower story is devoted to the machine shop, which is furnished with a boiler and steam engine of eight horsepower; a machinist's 'engine lathe', and two hand lathes, fitted with chucks, drills, etc.; a wood-turning lathe; a pattern-maker's bench, with its complement of tools; a blacksmith shop; molding-sand, crucibles etc. for making brass and other castings; several iron vises, and sundry other tools valuable in the machine-shop. The engine is of special design, being adapted to receive different sets of valve-gears, for the purpose of illustrating to the classes, in a working model, the different varieties of steam engine. In the mechanical shop, models and apparatus are constantly being made by the students, with the assistance of the director of the shops, and added to the present set of valuable illustrative apparatus of the class room.

"N. B. - Apparatus, of good quality, can be furnished for high schools and colleges. Orders are solicited."

The First Shops of the New Mechanical Building, 1872 - The Catalogue of 1872 and 1873, the first issue after the opening of the new Mechanical Building, and Drill Hall, described the shop equipment used by the Department of Mechanical Engineering somewhat as follows.

The boiler and furnace room of the new Mechanical Building contained a Root's Sectional Safety Boiler of 33 horsepower, which supplied steam for the engine and for warming the building. The forge and furnace were in this room and also a moulder's bench with sand and the appliances for making brass, iron, and other castings. The room also contained the pumps, a Stillwell heater and lime extractor for supplying the boiler with water.

The machine shop contained the engine that was designed by Professor Robinson and made by students in the University. Its nominal capacity was 16 horsepower, but was capable of developing 30 or even more. It was regulated by a variable cut-off of novel yet simple construction worked out by Professor Robinson. A Richard's indicator of the most approved pattern was

1 Page 20.

fitted to the cylinders. The main line of drive-shafting was cold-rolled iron, 72 feet long, and furnished with the best iron pulleys and hangers. The shop contained a Putnam engine lathe of 20-inch swing by 10-foot bed. It contained also an Ames lathe of 15-inch swing by 6-foot bed. It had, in addition, a Putnam planer for iron, planing 5 feet long. There were two hand lathes with swings about 10 inches by 4 feet that were made by the students. There was a stretch of about 100 feet of heavy hard-wood benches, fitted with vises, drawers, tool cases, etc. The steam-heating coils for the machine shop were under these benches. There was, furthermore, a grindstone, and a No.1 Sturtevant pressure blower for furnishing blast to the furnace and and forge.

In the pattern shop were four complete sets of tools, benches and vises, each sufficient for a pattern-maker. There was also a small buzz-saw.

Mechanical Engineering Shops, 1890-1895[1] - When the Military Department moved into its new Armory in 1890, the Department of Mechanical Engineering took over the space vacated on the second floor of the old Mechanical Building and Drill Hall, known at that time as Mechanical Building or Machinery Hall, and moved into it the machine shop, wood shop, pattern shop, and store room formerly located on the first floor of that building. At that time, and probably earlier, each of the four units, the machine shop, wood shop, forge shop, and foundry, was in charge of a separate instructor.

The machine shop occupied a room 80 feet by 124 feet, and contained twelve engine lathes of different makes, varying from 12 to 24-inch swing, ten hand lathes, one planer, two shapers, three drill presses, a small milling machine, a universal milling machine, a universal grinding machine, sixteen vises with corresponding benches, standard calipers, gauges, taps, dies, drills, reamers, etc. Between 1890 and 1895, there was added two more engine lathes, one of which had a

1 The Technograph, 1891-92, Front.

27-inch swing, and one planer 30 inches by 30 inches by 8 feet.

The one-story annex that was added to the building for a blacksmith shop in 1885, according to the 1891-92 issue of the University Catalogue, contained sixteen forges with power blast, and an equal number of anvils with accessory equipment.

After the foregoing changes, the foundry located on the first floor of the building was able to expand somewhat. In 1891-92, according to the records, it contained a cupola for melting iron, a moulding floor for sand, a number of flasks and necessary auxilliary facilities to accommodate 16 persons.

The University carpenter shop used for building repair and other general purposes and also for a wood-shop for the students in Architecture, was also located on the first floor of this building. In 1891-92, it contained an endless bed surfacer, pony planer, moulding machine, tenoning machine, shaping machine, jointing and rabbeting machine, boring machine, morticing machine, scroll saw, six sets of carving tools, and forty-eight cases of cabinet maker's tools with suitable benches. In 1894-95, according to The Technograph, the wood shop had fourteen new work benches, a universal trimmer, a 34-inch band saw, a 20-inch wood planer, and a full line of tools.

In 1894-95, the boiler room adjoining Machinery Hall, contained two 33-horsepower horizontal, tubular boilers, that furnished power for a 25-horsepower Ball[1] automatic engine and for heating the building and the new Armory.[2]

<u>Machine Shop or Machine Tool Laboratory, 1895-1945</u> - The University Catalogue of 1896-97[3] stated in regard to the machine shop then located in the new Mechanical Building later called Machine Tool Laboratory:

"The machine shop contains one 27-inch by 12-foot bed F. E. Reed & Company engine lathe; twelve engine lathes of from 12 to 20-inch range; two 10-inch speed lathes; one centering lathe; one 15-inch Gould & Eberhardt shaper; one 15-inch Hendey shaper; one No.3 Brown & Sharpe plain milling machine; one Brainard universal milling machine; one 20 by 20-inch by five-foot Putnam planer; one 30 by 30-inch by 8-foot G. A. Gray & Company planer; one No. 2 improved Brown & Sharpe

1 Sometimes rated as high as 50 horsepower.
2 The Technograph, 1894-95, page 180.
3 Page 69.

universal grinding machine; one Brown & Sharpe cutter and reamer grinder; one 24-inch drill press; one 20-inch drill press; one sensitive drill press; one water emery tool grinder; one center grinding machine; one Stover power hack saw; one Worcester twist drill grinder, complete set of United States standard taps and dies; drills, arbors; reamers, gear and milling cutters, calipers, caliper gauges, scales, and other small tools."

Another reference stated that:

"During the summer of 1913, several new machines were added to the shop. One was the horizontal drilling, boring, and milling machine manufactured by Lucas Machine Tool Company of Cleveland, Ohio. The spindle on this machine could be adjusted for height, thus doing away with the old method of adjusting the table to the spindle. Another machine was a tilted turret lathe manufactured by the Wood Turret Lathe Company of Brazil, Indiana. It was capable of taking work up to an inch and a half in diameter. Still another was a No.2 Universal cutter and tool grinder made by the Oesterlein Machine Company of Cincinnati, Ohio. It was capable of grinding, milling, and gear cutting.

"A new line shaft in two units was installed. One unit had roller bearings and was driven through a Morris silent chain drive by a separate motor. The other was belt driven and had an old style babbit bearing. The arrangement provided more floor space. The crane span was changed from 12 feet to 8 feet in order to make room for the new line shaft."[1]

During the next several years, the shops were provided with many new machines including gear-cutting and milling machines, automatic and turret lathes, engine lathes, shapers, planers, drilling machines, boring mills, precision and tool-grinding machines, and so on, several of which were equipped with dynamometers by means of which it is possible to obtain essential records of power input and consumption, friction losses, torque, and thrust in drilling and other operations.

In addition, facilities have been provided for making tests of lubricating oils in the study of such properties as specific gravity, viscosity, flash, fire, and color. Furthermore, there has been supplied a complete set of special tools, jigs, and fixtures for demonstrating the methods used in a modern mass-production shop.

In the almost half century that the Machine Shop or Machine Tool Laboratory has occupied its present quarters, the machines have become crowded because of limitations in space demonstrating the need of providing greater floor area for this purpose. In spite of limitations, however, the facilities have served the purpose of supplying training to long lists of students enrolled in the College courses and of furnishing valuable materials published in several bulletins issued

1 The Technograph, November, 1913, Volume XXVIII, No.1

by the Engineering Experiment Station.

Wood Shop - The 1896-97 Catalogue stated:[1]

"The wood shop occupies a part of the second floor of the Engineering Laboratory (old Wood Shop and Testing Lab. originally the Mechanical Building and Drill Hall) and contains twenty-six improved wood-working benches, fourteen of which are fitted with Wyman & Gordon patent vises; one 34-inch F. H. Clement & Co. band saw; one 36-inch Yerkes & Finan band saw; one 20-inch Clement & Company wood planer; one J. A. Fay & Co. jig saw; one J. A. Fay & Co. jointer; eight 10-inch wood lathes; one 18-inch pattern maker's lathe; one No. 4 E. Fox trimmer; together with a complete equipment of small tools."[2]

When the new Wood Shop Building was completed in 1902, it was provided with a lecture room, an exhibition room, a tool room, an office, a pattern-storage room, and a repair work room all in addition to a bench room, a lathe room and a machine room. Some of the equipment was transferred to these new quarters from the old shop building and laboratory mentioned in the preceding paragraph. Other portions of the equipment were new.

After the shop instruction was completely reorganized about 1926, students were no longer required to execute manual exercises in wood work, such as bench practice and turning. They were, however, required to carry on with training in the pattern laboratory, which has continued to be amply supplied with the necessary machines and tools for the design and production of metal and wooden patterns on a mass-production basis.

In 1937, the Division of Industrial Education of the College of Education began to utilize the facilities in the bench and lathe rooms for conducting teacher-training laboratory courses in industrial arts including wood working and general shop practice, and has continued to do so to date.

Foundry - The 1894-95 University Catalogue stated:[3]

The foundry is equipped with a small cupola, the necessary sand, ladles, crane, and flasks for making castings."

It was then located in the old Mechanical Building and Drill Hall. The next year it was moved into its new quarters called Machinery Hall (now Machine Tool Laboratory) and the 1896-97 Catalogue stated:[4]

---

1 Page 69
2 After the fire of 1900, a wood shop was provided temporarily with new equipment in the basement of the Mechanical and Electrical Engineering Building.
3 Page 51
4 Page 70

"The foundry occupies a room 48 by 48 feet in Machinery Hall and is equipped with a 24-inch Whiting patent cupola, of two-tons capacity, a core oven, and the necessary sand, ladles and flasks for making castings. A No.7 Buffalo steel pressure fan furnishes the blast for the cupola". A small traveling crane had also been provided at that time.

According to the records of 1918, the foundry then had a brass furnace with a capacity of 500 pounds of brass at one time, and it had also an electric gyratory riddle, and a Tabor shockless jarring roll-over moulding machine.

Several new machines were installed in 1923. A Jolt Stripper machine made by Osborn Manufacturing Company was used in connection with the Tabor Stripper machine, the Jolt Stripper being used to produce the cope or upper part of the flask, and the Tabor machine the drag, or the lower part of the flask. Both machines automatically rammed the sand and drew the patterns. The two machines were used principally in the production of fly-wheel, crank-case, and cylinder-block castings for the gas-engine parts that were being turned out on a commercial scale in the shops as student exercises.

An International molding machine of the roll-over pattern draw-type, manufactured by the Standard Equipment Company, was also installed in 1923, and was used in "tumbling" the production castings of the gas engines manufactured by the students in the shops.

There was acquired in 1924-25 one radiation pyrometer, two Brown long-distance recording thermometers, one grinding machine, and one universal sand riddle. There was installed in 1927-28, a Booth electric furnace for experimental work in the foundry laboratory. It operates on 110 volts, 185 amperes, and is capable of melting 60 pounds or iron or steel in about 30 minutes. The laboratory received also at that time, a McIlvine moisture recorder for the determination of moisture content of molding sand.

Other equipment was provided from time to time so that in 1945 the facilities include complete apparatus for testing, sifting, mixing, and grading foundry sands; various types of moulding machines, including stripper, squeezer, roll-over, and

jolt varieties; a cupola for the melting of gray iron; an electric and a gas furnace for melting of non-ferrous metals; a crucible pit; apparatus for making and baking cores, and for the study of core oils; and necessary machinery for cleaning castings. In addition to receiving instruction in foundry practice, many students have been able to carry out experiments of their own in connection with special problems that have arisen in their own practical experience. Besides all that, the staff has been able to utilize the facilities to provide data for a number of bulletins issued by the Engineering Experiment Station.

Forge Shop - In 1894-95, according to the University Catalogue, the forge shop, then located in the Mechanical Building and Drill Hall, contained, as previously stated, sixteen forges fitted with a blower or power blast, exhaust fan, and the necessary small tools. In 1895, the equipment was transferred to Machinery Hall (now the Machine Tool Laboratory); and the 1896-97 issue of the Catalogue stated that the forge shop occupied a room 36 feet by 48 feet in the east end of this building, and contained ten of the latest improved Buffalo down-draft forges. Blast was furnished these forges by a No. 5 Sturtevant pressure blower, and all gases of combustion were exhausted underground by means of a No.9 Sturtevant exhaust fan. The shop was also equipped with the usual supply of small tools.

When the foundry was moved from the middle room in Machinery Hall to its present location in the east end of the Wood Shop Building in 1904, the forge shop was moved from the east room to the space thus vacated in the middle room.

A new punching and shearing machine driven by a 5-horsepower motor was installed in the forge shop according to the March, 1912, issue of the Technograph. The machine had a 24-inch jaw and was fitted with complete attachments for punching and shearing iron bars, steel plates, angle iron, and round and square rods. During 1912, a 350-pound Niles Bement steam hammer was added to the equipment in the forge shop, the old forges being taken out and sold. For experimental and instructional use in the forge laboratory, the Department constructed during 1921-22 a 100,000-pound hydraulic testing machine after plans prepared by Professor H. F. Moore of the Department of Theoretical and Applied Mechanics.

In many respects the machine is similar in design to its 25,000-pound prototype built in the Shop Laboratories in 1914, except that the earlier machine was equipped with a hand-operated hydraulic pump.

The forge laboratory was entirely rearranged in 1923. The east room of the laboratory was equipped for work in the heat-treatment of steel -- all forging machines and apparatus being removed to the west room, which was continued as the metal-working laboratory. All instructional work in the forge shop was discontinued, however, in 1926, and the forges and forging equipment were removed to provide additional space for the heat-treatment equipment.

Heat-Treatment Laboratory - The work in the heat-treatment of steel began about 1910-12 in connection with forge-shop practice. An oxy-acetylene welding and cutting outfit was set up in the forge laboratory in 1914; and a full revision was made of the equipment for the study of heat-treatment. Five gas and electric furnaces with cyanide and oil baths that were provided within the next four years were placed under a ventilated steel housing.

When the forge laboratory was rearranged in 1923, the entire east room of the Machine Tool Laboratory Building was set aside for the work in heat-treatment of metals, as previously mentioned. The furnaces were located in a group in this heat-treatment room. A physical laboratory was set up adjacent to the battery of furnaces so that the students could study heat-treated materials by means of the Brinnell and scleroscope machines acquired at that time. A new microscope was also added then for use in the examination of heat-treated steels. Other equipment provided with the next year or so consisted of a gas heat-treatment furnace, an electric furnace, a crucible heat-treating furnace, recording controllers, and additional microscopes.

When the forge laboratory was discontinued as such in 1926, the space was given over to additional heat-treatment furnaces and other heat-treatment facilities -- the equipment in the east room being transferred to the space thus vacated. Additional apparatus supplied at that time or shortly thereafter included a Rockwell hardness testing machine, an electric etching and demagnetizing

machine using 110-volt alternating current, gas and electric furnaces, recording scleroscopes, a tensile testing machine, polishing and etching machines, metallurgical microscopes, indicating and recording pyrometers, a micrograph camera, and miscroscopes --- all for the meticulous study of the annealing, hardening, tempering, and carburizing processes involved in the production of carbon and alloy steels and of the heat-treatment of non-ferrous metals.

Cutting and Welding Laboratory - In the summer of 1936, the Physical Plant Department of the University prepared space for a new welding laboratory in the Wood Shop by removing the partitions between the old lathe room and the store room. This new space was provided with a concrete floor. In September, 1936, the Linde Air Products Company installed the necessary piping and manifolds for fifteen oxy-acetylene torches. This company then made a permanent loan to the Department of the fifteen torches, together with sufficient regulators and other equipment, so that all of the torches could be used simultaneously. From time to time, other organizations, also, have loaned equipment including direct-current and alternating-current appliances, for use in connection with the welding course.

In addition to the gas and cutting and welding apparatus, there has been added a variety of polishing and etching equipment, a number of microscopes, and an assortment of testing machines, for the scientific study of the usual types of electric-arc and oxy-acetylene welding processes employed in commercial and industrial practice.

G. MUSEUM MATERIALS AND COLLECTIONS

General - Due to lack of space suitable for assembling and exhibiting museum materials, the Department has not been able to accumulate any more than the very few pieces of equipment mentioned below that have had some special significance in connection with University development or relationships.

Robinson Engine - The original 35-horsepower steam engine made by Professor Robinson and his students within a year or so after the Department began in the early '70's, is mounted on the main floor of the Mechanical Engineering Laboratory where it is being preserved as a tribute to the work of this great pioneer in

engineering education.

Chicago Edison Company's Triple Expansion Engine and Generator - The Department has installed on the main floor of the Mechanical Engineering Laboratory one of the original ten 600-horsepower engines that were built by the Southwark Foundry and Machine Company of Philadelphia, and that were operated for a number of years in the Harrison Street Station of the Commonwealth Edison Company, having been erected there in the winter of 1893-94 and placed in service on August 1, 1894 -- this particular one having been presented to the University on March 8, 1916, by Samuel Insull for his corporation.

Originally, there were connected to the engine, one on each side, two 200-kilowatt, direct-current generators, built by the General Electric Company. The Chicago Edison Company later replaced these generators with the present double-current machines, one for alternating and the other for direct current, which were among the first of this type of generators constructed.

During its day, this plant was considered to be among the most outstanding of its kind in this country and attracted wide attention. The rapid progress made in the design of central-station facilities, however, soon made this particular equipment obsolete.

Other Materials - The Register of 1915-16 contained the following statement[1] regarding museum materials and collections:

"This department includes in its equipment a set of Reuleaux models, models of valve gears; sections of steam pumps; injectors; valves, skeleton steam and water gauges; standard packings; steam-pipe coverings; and drop forgings. There are also examples of castings; perforated metal, defective boiler plate, and a set of drills, with samples of oil, iron, and steel. A number of working drawings from leading firms form a valuable addition to the collection."

H. FACULTY PERSONNEL

General - A complete list of faculty members who have been connected with the Department of Mechanical Engineering in any capacity with the rank of instructor, research assistant, or higher grade, together with brief biographical sketches giving dates of connection with the University, promotions, titles, and other items of interest compiled from official sources, is presented in chronological

1 Page 65.

order according to rank in the following pages.

a. Heads of the Department

General - Stillman Williams Robinson served as Head of the Department of Mechanical Engineering from 1870 until 1878. Selim Hobart Peabody succeded him with the title of Professor of Mechanical Engineering and Physics and continued until 1881, when he became Regent of the University. He was followed by his son, Cecil Hobart Peabody, who remained Head of the Department until 1883. Arthur Tannant Woods succeeded him and continued until 1891, after which Charles Walter Scribner was Head until 1893. Lester Paige Breckenridge then became Head of the Department and continued until 1909, after which, George Alfred Goodenough, as Assistant Professor of Mechanical Engineering, was Acting Head from 1909 to 1911. Charles Russ Richards succeeded him and was Head until 1920. Arthur Cutts Willard then followed, serving as Head from 1920 to 1933. Oscar Adolph Leutwiler became Head in 1933 and continued in that capacity until 1945, when Alonzo Plumsted Kratz became Acting Head. Brief biographical sketches of these men follow.

Stillman Williams Robinson was born on a farm near South Reading, Vermont, March 6, 1838. He served four years, 1855-59, as an apprentice in a machine shop. This experience impressed him with a desire for a college education in mechanical engineering, but he could find no institution offering such a course. He decided that the best he could do was to take a course in civil engineering in the University of Michigan. With only eight dollars in his pocket, he started on foot for that institution. It is not known how long it took him to cover the distance, more than 600 miles; but it is known that when he arrived he had fifty-eignt dollars, which he had earned on the way working as a mechanic. On January 1, 1861, he entered the University of Michigan as a sophomore in civil engineering, and was graduated in June, 1863. He paid his way through college by graduating thermometer scales, at first doing his work by hand, and later making a machine for the purpose which enabled him to employ other students to help him in the business. From 1863 to 1868 he was an assistant in the U.S. Lake Survey; from September, 1866, to January, 1870, he was a teacher in

the University of Michigan -- for the last three years being Assistant Professor of Mining Engineering and Geodesy. His graduating thesis was entitled "A New Form of Suspension Bridge"; and within the next year after graduation he published in the Journal of the Franklin Institute two papers on that subject and a third upon a related subject. In the second year after graduation he published articles on magnetic circuit breakers, structural mechanics, and a classic on Stadia Surveying. The third year after graduation he put forth a paper showing how to attain certain artistic effects with the jets of water of a fountain. In 1867, then very early in the history of machine rock-drills, he took out a patent on a steam rock drill which he had tested in the Hoosac Tunnel, then a grave-yard for many rock-cutting devices. It is said that two men with Robinson's drill could do as much work as sixteen with the machine boring next to his.

It would have been difficult, if not impossible at this time, to have found a man with a more promising education and better technical record for a pioneer professor of mechanical engineering; and subsequent events show that he was equally well equipped in other important respects.

Although instruction in the University began March 2, 1868, the College of Engineering may be said to have started as a separate entity when Professor Robinson entered upon his duties as Professor of Mechanical Science and Engineering. The appointment of Professor Robinson on December 13, 1869, and his entry upon his work January 1, 1870, inaugurated the third attempt in this country to give instruction in mechanical engineering -- Massachusetts Institute of Technology having already preceded it in 1865, and Worcester Polytechnic Institute, in 1868.

Professor Robinson's work in his recitation room was a unique innovation and an inspiration to his students. The class room work in machine design was professedly instruction in invention; and while it violated some fundamental principles in education, it was eminently successful in arousing the enthusiasm of the students, and it is certain that the results justified the method. With small classes and a genius for a teacher, some of the more staid rules of educational practice may be disregarded. The fact that Professor Robinson obtained about

forty successful and valuable patents, besides being the inventor of several important machines and mechanical devices that are not patented, is some evidence that the classroom work in machine design was neither aimless or useless, and that it conformed to good mechanical practice. All of Professor Robinson's inventions were the results of study and investigation, and were not accidental discoveries. Of the machines designed in the classroom and made in the machine shop (described later in this chapter) by the students under the direction of Professor Robinson, Professor Baker recalled the following: (1) first chronologically, a steam engine which furnished the power for the University shop for twenty-five years, and which had some features about it that were then new but are now regarded as standard practice; (2) a number of ingenious and novel mechanical movements for use in the recitation room; (3) numerous pieces of illustrative apparatus; (4) an automatically directed helioscope for the "United States Lakes Survey"; (5) a lawn mower for the University; (6) a tool and guides for trimming photographs; (7) a machine for automatically graduating thermometer scales, which seems to be the sole one in use in the world today; (8) a sewing machine with a new shuttle motion and a new type of treadle; and (9) last chronologically, our own tower clock, now in the Union Building, a clock of novel design which for about seventy years has continued to announce the time accurately.

Professor Robinson during the eight and one-half years he was connected with the University, in addition to his duties as Professor of Mechanical Engineering, personally taught all the classes in mining engineering and in physics, and for several years he gave lectures on geodesy to civil engineering seniors, even after a Professor of Civil Engineering had assumed his duties.

As will be explained later, Professor Robinson's work in physics, in scope and novelty, was second only to that in machine design.

In still another field Professor Robinson was more than a professor of mechanical engineering, for during his first two or three years of service at the University, he gave all the technical engineering instruction; and as long as he remained at the University, he taught some of the leading subjects taken by all

engineering students. His work in resistance of materials and in hydraulics was fully as stimulating and creditable as his work in machine design and in physics. In these subjects there was no apparatus, but he so enthused his students that they were more than willing to work on Saturdays and in vacation constructing apparatus in order that they might make experiments and conduct research. Thus was implanted one of the highest forms of education. He proposed to his class in hydraulics a modified form of the Pitot tube for measuring the velocity of flowing water. The instrument was made by his students in the shop, and tested by them in the river at Danville, Illinois; and ten years later this improved form of Pitot's tube was the only apparatus that could accurately measure the outflow of natural gas from wells in Ohio and Indiana.

But incidentally, Professor Robinson performed a greater service to the University and to the cause of engineering education than to devise instructive apparatus or to conduct interesting experiments. Many people believed that this institution was founded as a protest against past educational practice; and many, if not most, of the students seeking preparation for the practice of engineering, misapprehended the purpose and method of what is not generally recognized as the most approved form of engineering education. Many of them thought that the sole purpose of the College was to give them engineering information in a predigested form. Fortunately, for the University of Illinois, Professor Robinson had clear and correct conceptions as to the better forms of engineering instruction, and his methods and ideals dominated in the early history of the College of Engineering. Almost contemporaneously with the coming of Professor Robinson to the University, there was published in what has since rightly become a noted engineering handbook, a statement boldly asserting that higher mathematics was useless to an engineer. This statement greatly impressed the engineering students of that day, and strongly tended to alienate them from that mathematical and scientific preparation now universally recognized as necessary for any reasonable engineering education. Professor Robinson's versatility, ability, and enthusiasm in his work, and his constant and effective use of higher mathematics, however, were very

influential in leading students to adopt the better ideals of an engineering education. He did this by force of his example, without argument or ostentation, just as the light of the rising sun dispels the fog, gloom, and darkness of the night.

In still another way Professor Robinson performed a service of inestimable value to the College of Engineering. For several years after this institution was inaugurated, there was much skepticism among practicing engineers as to the possibilities of giving through college instruction any conception of the principles and practice of engineering. The early students of this institution found it unwise to disclose the face that they had taken collegiate training in engineering; but Professor Robinson's acquaintance with practicing engineers enabled him to help students to positions where they were able to demonstrate the value of the engineering education given here, and thus aided in dispelling, in some quarters, at least, doubts as to the value of collegiate instruction in engineering.

Finally, in a still more important way, Professor Robinson's work contributed materially to general University interests. The work of the Engineering College was more easily exhibited to the public and more easily understood than the work of most other departments, and hence it contributed a large share to the early reputation of the University -- a reputation which the struggling institution greatly needed in those early days. "The engine designed in the classroom and made in the shop by the students", as the phraseology always ran, was frequently pointed out with pride by president, faculty and students; and the personal accomplishments of Professor Robinson were frequently referred to in public and in private, in discussing the success of the University. Under such circumstances it is not surprising that for at least the first twenty-five years there were more students in the College of Engineering than in any other College, and for many years the engineering students constituted from half to two thirds of the men students. Rightly, then, the history of the College of Engineering of the early days is in a large measure the history of the University; and without the insight, ability, and enthusiasm of the first professor of engineering that

history might have been very different.

In addition to directing the work and teaching in mechanical engineering and physics, Professor Robinson became Dean of the College of Engineering in February, 1878. On September 1, of that year, however, he resigned both positions to accept an appointment as Professor of Mechanical Engineering and Physics at the Ohio State University. It was unfortunate for the University that the condition of its finances seemed to make it necessary to permit Professor Robinson to leave for a paltry difference of $450 in salary; but it was fortunate indeed that his ideals and methods had so permeated the work of the College that after his departure, they continued to dominate. The University of Illinois, and particularly its College of Engineering, owes to Professor Robinson a debt for his services in a critical period of its history that has never been adequately recognized.

In a letter addressed to the Board of Trustees, Regent Gregory made the following comment when he announced the resignation of Professor Robinson: "It is with profound regret that I announce to you the resignation, since your last meeting, of Professor S. W. Robinson, who has so long and ably filled the important chair of mechanical engineering. It is due to those who have served faithfully and efficiently, that some recognition be made of the value of the services rendered, and of an appreciation of their good qualities, as well as of their fidelity and success. Professor Robinson, though still a young man, has already made a reputation in his department on both sides of the Atlantic, and stands today among the recognized authorities in mechanical science. The untiring zeal and energy with which he has worked for the development of the school of mechanical engineering, are too well known to need new testimony. The position that this school occupies in our University is due chiefly to his ability and enthusiasm. It mitigates, if possible, my regret at his loss to know that he will be organizing, elsewhere, another centre of education, so important to our country."[1]

Professor Robinson served Ohio State University as Professor of Mechanical Engineering and Physics until 1881, and then as Professor of Mechanical Engineering until 1895, when he resigned to devote his time to private practice.

1 Report of Board of Trustees, University of Illinois, 1877-78, page 105.

In addition to his duties at the University of Illinois and later at Ohio State University, Professor Robinson was consulting engineer for the Santa Fe and other railroads. He also acted as Inspector of Railways and Bridges for the Railroad Commission of Ohio during 1880-1884. In addition, he was consulting engineer for the Lick Telescope and Mountings Company in 1887. In all, he patented about forty inventions, among these being the first machine to be produced for graduating thermometers, as mentioned earlier.

After leaving the University, Professor Robinson became interested in the development of machinery for manufacturing shoes, and amassed a considerable fortune from the royalties on his numerous patents and from fees as consulting mechanical engineer for several manufacturers. He was the author of many magazine articles and pamphlets. He was a member of several engineering and other scientific societies, being a charter member of the Society for the Promotion of Engineering Education. He was awarded the honorary degree of D.Sc. by the Ohio State University in 1896. He was made Professor of Mechanical Engineering, Emeritus, at Ohio State in 1899, and died on October 3, 1910.

Of the two landmarks which still serve to honor the memory of Professor Robinson here, one is the old clock which he designed and built for the Class of 1878 and which was formerly in the west tower of University Hall, but which is now in the Union Building, and the other is the steam engine, now set up as museum material in the Mechanical Engineering Laboratory, which was designed by him and built by his students in the old original shops, and which for a quarter of a century furnished power for University purposes.

Selim Hobart Peabody - Much of the biographical sketch of Selim Hobart Peabody was given under Regents in Chapter II. There are, however, some points of particular engineering interest that should be mentioned here.

Doctor Peabody was a scholarly man of wide experience in teaching, but his work had been mostly in high-schools -- his experience in teaching engineering subjects having been limited to a brief period in each of two elementary collegiate institutions. As previously stated, he became Professor of Mechanical Engineering and Physics on October 10, 1878. He followed Professor Robinson's

method in teaching machine design, but lacked the latter's experience as a machinist and as a designer. His work in physics, however, was very interesting and invigorating, as he had rare facility in devising instructive and striking experiments and in drawing illustrations from a wide range. He was popular with his students for the nearly two years that he was Professor of Mechanical Engineering and Physics. Although Professor Peabody became Regent in 1880, he continued for several years to be the nominal head of the Department of Mechanical Engineering. and to teach subjects in the mechanical-engineering curriculum.

Cecil Hobart Peabody, son of Regent Selim Hobart Peabody, was born at Burlington, Vermont, on August 9, 1855, and was graduated from Massachusetts Institute of Technology with the degree of S.B. in 1877. He had acquired considerable machine shop practice during his early years, and from 1879 to 1881 had been Professor of Engineering at the Imperial Agricultural College in Japan. In September, 1881, he became Assistant Professor of Mechanical Engineering and virtually Head of the Department at the University of Illinois. Technically, he was well prepared to undertake the duties of the office, and under ordinary circumstances he would have succeeded; but because he was the son of the Regent, he had his problems. Some claimed he had obtained his position through favoritism. Furthermore, the adjustment of some difficult University administrative problems had alienated the students from the Regent, in consequence of which, the son suffered. In 1883, he accepted a call to the faculty of his alma mater, where he was an honored and successful engineering teacher for thirty-seven years, retiring in 1920 as Professor of Naval Architecture and Marine Engineering, _Emeritus._ He died in 1934.

Arthur Tannant Woods was born at Minneapolis, Minnesota, on January 9, 1850. He served as Cadet Engineer at the U. S. Naval Academy from 1876 to 1882, where he was also employed in the Bureau of Naval Construction. He received the M.M.E. degree at Cornell University in 1890. Mr. Woods served as Assistant Professor of Mechanical Engineering at the University of Illinois, virtually in charge of the Department, from 1883 to 1887, and as Professor of Mechanical Engineering and Head

of the Department here from 1887 to 1891. He was a scholarly and forceful man who easily held the respect and confidence of his students. Under his administration the work of the Department advanced quietly and continually in both quality and scope. On June 3, 1891, greatly to the regret of all connected with the University, he resigned to become Professor of Dynamic Engineering at Washington University, St. Louis. He remained there only a year, however, when he left to become Associate Editor of the Railroad Gazette and Consulting Engineer in Chicago, where he died on February 7, 1893.

Professor Woods was co-author with Albert W. Stahl of a textbook entitled "Elementary Mechanism", and was author of another textbook entitled "Compound Locomotives". He also contributed many articles to the technical press.

Charles Walter Scribner was born at Red Bank, New Jersey, on September 7, 1857. He received the A.B. degree at Princeton University in 1880, the M.A. degree there in 1885, and the M.E. degree at Stevens Institute of Technology in 1882. He came to the University of Illinois, following administrative and teaching experience at Iowa State College and Cornell University. He served as Head of the Department of Mechanical Engineering here at Illinois from September, 1892, to September, 1893. In 1903, he was associated with a firm in New York City as consulting engineer, and in 1905, he was in business for himself. For a number of years past, he has made his home at 713 Watchung Avenue, Plainfield, New Jersey.

Lester Paige Breckenridge was born at Meriden, Connecticut, on May 17, 1858. He received the Ph.B. degree at the Sheffield Scientific School, Yale University, in 1881, and the A.M. there in 1909. He served as Instructor in Mechanical Engineering at Lehigh University from 1882 to 1891, and as Professor of Mechanical Engineering at Michigan Agricultural College from 1891 to 1893. He then came to the University of Illinois as Head of the Department of Mechanical Engineering. Having acquired in addition to his teaching work considerable experience as a workman in a machine shop and as supervising engineer for a large zinc, iron, and steel company at Bethlehem, Pennsylvania, he was well prepared for his new

position; and with his coming the Department of Mechanical Engineering made great strides. He had a pleasing personality, genial good nature, a broad knowledge of men and affairs, and a contagious enthusiasm; and he proved to be a valuable asset in University life. He was the first person at Illinois to be elected as an honorary member of Tau Beta Pi.

Professor Breckenridge made many notable contributions to the remarkable growth of the University of Illinois during his sixteen years of service here. He was placed in charge of the University heating system at a time when the boiler plant was somewhat dilapidated and greatly over-taxed; but by keeping on hand large quantities of material needed for repairs, by carefully instructing the stokers, by frequent inspections, and by making repairs at night and on Sundays, he kept the plant going without interruption, a condition which was new in the history of the University. He gave large credit for success in this difficult task to Mr. Joseph Morrow, a young man then just out of his teens, who continued to render efficient service in supervision of the heating plant until his death in 1940. Professor Breckenridge designed and installed the Boneyard Central Heating and Lighting Plant, and devised and constructed the tunnel system containing distributing pipes for steam, gas, compressed air, and wires for telephone and electric power and lights. He extended the equipment of the machine shop, moved it from the first floor of the old Mechanical Building and Drill Hall to the second floor of that building, and later transferred it to Machinery Hall, now known as the Machine Tool Laboratory; and besides, enlarged the scope and improved the quality of the shop work. Then, too, he designed and installed a mechanical engineering laboratory setting it up first in the old Chemistry Building, then later moved it to the Mechanical and Electrical Engineering Laboratory Building, and still later to the first units of the present Mechanical Engineering Laboratory, expanding the equipment from time to time, and thereby improving the facilities for mechanical engineering laboratory work. Professor Breckenridge also inaugurated a system of cooperative locomotive testing with the Illinois Central Railroad and devised and supervised the construction of a dynamometer car for tests

of locomotive performance and for determination of train resistance. The car contained numerous self-recording instruments invented by him or under his direction. In addition, he rendered service of great value in establishing cordial relations between the College of Engineering and the railway, manufacturing, and mining interests of the State. Furthermore, he directed researches in the economic uses of fuel by the U. S. Geological Survey in connection with the Louisiana Purchase Exposition at St. Louis in 1903-04, and gave valuable service to public-utility plants in Illinois concerning the economic use of coal. Finally, he was first to propose the establishment of the Engineering Experiment Station, and was exceedingly active in promoting the plan and securing in 1903 the initial legislative appropriation for that purpose. Fittingly enough, he was the first Director of the Station, serving from 1905 to 1909 as previously stated, filling the position with distinguished ability. He was author of two bulletins and one circular and was co-author of three bulletins and one circular published by the Station.

In addition to his many contributions towards the advancement of the Department of Mechanical Engineering and the College of Engineering, Professor Breckenridge made many friends for the University; for his genial manner, tactful activity, and his abundant enthusiasm and initiative made him a favorite with students, the faculty, and the public. On this account, it was with keen regret that the University was obliged to receive his resignation in the summer of 1909, when he left to join the staff of his alma mater as Professor of Mechanical Engineering and Head of that Department at Yale University. As a token of its appreciation of his ability and of his services to the University and the State, the University in 1910, conferred upon him the honorary degree of Doctor of Engineering.

Professor Breckenridge remained at Yale until 1923, when he was retired with the title Professor of Mechanical Engineering, _Emeritus_. After that he made his home in North Freisburg, Vermont, until his death on August 22, 1940.

Charles Russ Richards- Biographical Sketch given under Deans in Chapter V.

Arthur Cutts Willard - The main portion of the biographical sketch of Arthur

Cutts Willard, who was connected with the Department of Mechanical Engineering here from 1913 to 1933, being Head of the Department from 1920 to 1933, was given in Chapters III and V. There are many other features of his work, however, that have a professional interest that are mentioned here.

Professor Willard was joint author with Professor L. A. Harding of a two-volume textbook entitled "Mechanical Equipment of Buildings",—Volume 1, "Heating and Ventilation", and Volume II, "Power Plants and Refrigeration". He was joint author also with Professor Harding of another textbook entitled "Heating, Ventilating, and Air-Conditioning". Professor Willard served as President of the American Society of Heating and Ventilating Engineers for the year 1928.

During such time as he could spare from his regular teaching and administrative duties, Professor Willard devoted himself to research work in the University, taking part in the actual conduct of experiments and directing many others in heating, ventilating, and air-conditioning, undertaken by members of the staff of the College and the Engineering Experiment Station. He was the author of one and joint author of eight, bulletins issued by the Station.

During his spare time, too, Professor Willard acted as consulting engineer for various organizations of public interest. In 1920, he was appointed as Consultant on Ventilation for the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission. In 1921, he was appointed Consulting Mechanical Engineer for the U. S. Bureau of Mines. In the capacity as consultant for these two organizations he directed an extensive investigation into the problems involved in the ventilation of the Holland Tunnel for automobile traffic under the Hudson River between New York and Jersey City that received national recognition. In 1930, he was appointed consultant on ventilation of the proposed Chicago subway for the Bureau of Subways, and in 1931 acted in a consulting capacity on the ventilation for the proposed Midtown (38th Street) Hudson River Tunnel.

<u>Oscar Adolph Leutwiler</u> was born at Highland, Illinois, on February 16, 1877. He received the B. S. degree in Mechanical Engineering at the University of

Illinois in 1899, and the M.E. degree here in 1900. He served as Fellow in Mechanical Engineering at the University during 1899-1900, draftsman with a commercial firm in 1901, Instructor in Lehigh University during 1901-03, then joined the University of Illinois as Assistant Professor of Machine Design. He became Professor of Machine Design in 1915 and Professor of Mechanical Engineering Design in 1921; and held that latter title until 1945, having been, in addition, Head of the Department of Mechanical Engineering since July, 1934. Reaching the University age limit in September, 1945, he was retired with the title of Professor of Mechanical Engineering Design, Emeritus.

Professor Leutwiler is author of two textbooks, "Elements of Machine Design", and "Problems in Machine Design", and is co-author of one circular of the Engineering Experiment Station. He was a pioneer in rigorous mathematical analysis of many important machine elements, such as brakes, clutches, and ball and roller bearings. He is an engineer of ability and attainments, an excellent teacher, recognized authority in machine design, and his books are widely used in the classroom and in engineering practice. He has given unstintingly of his time to students, and has maintained most intimate and helpful relations with them before and after graduation.

b. Other Professors

George Alfred Goodenough (B.S., 1891, Michigan Agricultural College; M.E., 1900, University of Illinois), served as Instructor in Mechanics at Michigan Agricultural College during 1891-93, then was associated with the International Correspondence School of Scranton, Pennsylvania, from 1893 to 1895, where he prepared texts in various branches of engineering. After Professor L. P. Breckenridge came from the Michigan Agricultural College to the University of Illinois as Head of the Department of Mechanical Engineering, he invited Mr. Goodenough to become Instructor in Mechanical Engineering here. Young Goodenough accepted the position and remained here for two years, but returned to the International Correspondence School to an editorial position which he held for two years more. During all of his connection with this School, Mr. Goodenough was responsible for the preparation of a number of textbooks used in their correspondence work. In 1899, he returned to the University of Illinois as Assistant Professor of

Mechanical Engineering. Thus began the work of a man who rendered to the University valuable service as a teacher and research worker. He was made Associate Professor of Mechanical Engineering here in 1906. In 1911, his title became Professor of Thermodynamics, and he came to be recognized as a leading authority, if not the foremost one, in that line in this country. After Professor Breckenridge resigned in 1909, Professor Goodenough served as Acting Head of the Department for two years.

Professor Goodenough was joint author of two books on Calculus and was author of "Principles of Thermodynamics", and "Properties of Steam and Ammonia", and, in addition, wrote the chapter on Thermodynamics in the American Civil Engineer's Handbook, and a chapter on Heat in the Mechanical Engineer's Handbook. He was author of one bulletin and co-author of five more published by the Engineering Experiment Station. In serving on committees both College and University, in preparing reports, and in presenting addresses to students, Professor Goodenough rendered a valuable service second to none. As an excellent teacher, brillant analyst, author of important textbooks, and as noted in the engineering world for his exposition and researches in thermodynamics, he added strength and fame to the College staff. Professor Goodenough continued to be active in his University work until his sudden death on September 29, 1929.

<u>Louis Allen Harding</u> (B.S., 1899, and M.E., 1902, Pennsylvania State College) served as Instructor in Cornell University during 1902-03, as Professor of Machine Design in Pennsylvania State College during 1905-06, and as Professor of Mechanical Engineering and Head of the Department at the same institution during 1909-12. During the remainder of the time from 1899 to 1915, he was employed in engineering practice. He was engaged in independent consulting work in New York City during 1912-13, and joined the staff at the University of Illinois in 1913 as Professor of Experimental Engineering in charge of the Mechanical Engineering Laboratory. While here he collaborated with Professor A. C. Willard in the production of a two-volume textbook entitled "Mechanical Equipment of Buildings",— Volume I, "Heating and Ventilation", and Volume II, "Power Plants and

Refrigeration", and with him, also, in another textbook entitled "Heating, Ventilating and Air-Conditioning". Professor Harding resigned in February, 1916, to engage in engineering contracting work.

Bruce Willet Benedict (B.S., 1901, and M.E., 1923, University of Nebraska) having worked as a machinist with the Chicago, Burlington, & Quincy Railroad for three years before going to college and for three summers while enrolled at college, returned to that line after graduation; and for the six years he spent there he became successively inspector, foreman and general foreman. During 1906 to 1908, he was editor of Railway Master Mechanic, a monthly magazine published in Chicago. From 1908 to 1911 he was Supervisor of Shop Production for the Santa Fe System, during which time that road was engaged in some pioneer experiments in shop organization based on what has since been called scientific management, and in which some remarkable and well-known results were obtained.

He came to the University of Illinois on January 3, 1911, in charge of instruction in the shops, and continued in charge of that work until his death on November 21, 1927 -- his last title having been Manager of Shop Laboratories, with the rank of professor.

Professor Benedict was co-author of a book entitled "Railway Shop Up-to-Date", and was editor of "Betterment Briefs". He was joint author of two bulletins published by the Engineering Experiment Station of the University of Illinois, and was a contributor of many articles to the engineering press.

Alonzo Plumsted Kratz -(B.S., 1907, and M.S., 1909, University of Illinois) served as Assistant in the Engineering Experiment Station here during 1908-10, Instructor in Mechanical Engineering during 1910-12, Research Assistant in the Experiment Station during 1912-15, Research Associate during 1915-18, and Research Assistant Professor during 1918-21. He became Research Professor of Mechanical **Engineering in 1921 and has remained with the University to date, serving, in addition, as Acting Head of the Department from the time of the retirement of Professor Leutwiler until the selection of his successor. Professor Kratz,** a foremost authority in the field of heating, ventilating, and air-conditioning, has produced experimental results that have given great prestige to the University of Illinois. He is author of two bulletins, and is co-author of twenty-four

bulletins, four circulars, and one reprint published by the Engineering Experiment Station.

Clarence Walter Ham (B.M.E., 1905, University of Kentucky; M.E., 1908, Cornell University) was Instructor in Mechanical Drawing and Machine Shop Work at the University of Kentucky during 1906-07, He served as Instructor in Machine Design at Cornell University during 1908-13 and Assistant Professor during 1914-17. From 1917 to 1921, he was engaged in engineering practice in New York State. He came to the University of Illinois in February, 1921, as Associate Professor of Machine Design, and since 1926, has had the title of Professor of Machine Design. Professor Ham is co-author of a textbook entitled "Mechanics of Machinery", and of a section on "Pipes and Fittings" in Mark's Mechanical Engineering Handbook. He is co-author of two bulletins published by the Engineering Experiment Station.

Everett Gilham Young (B.S., 1913, M.S., 1916, and M.E., 1923, University of Illinois), was employed in engineering practice during 1916-19. He served as Professor of Railway Mechanical Engineering in the Chinese Government Engineering Colleges from 1919 to 1924, and as Assistant to the Technical Advisor of the Chinese Government Railways from 1924 to 1927. He came to the University of Illinois in February, 1927, as Researdh Professor of Railway Mechanical Engineering in the Department of Railway Engineering. When this Department was discontinued in 1940, Professor Young was transferred to the Department of Mechanical Engineering with the title Professor of Railway Mechanical Engineering, which position he has held to date.

While in China, Professor Young was honored with the Civil Merit Order of the Chinese Government. He is author of two bulletins and co-author of one, published by the Engineering Experiment Station at the University of Illinois -- all studies involving the performance of steam locomotives.

Joseph Albert Polson (B.S., 1905, and M.E., 1911, Purdue University), taught at Michigan State College from 1906 to 1919, then was employed in industry from 1919 to 1921. He joined the faculty at the University of Illinois in January, 1921, as Associate Professor of Steam Engineering. He became Professor of Steam

Engineering in 1927, and retained that position until 1945 when he reached the University age limit and was retired with the title of Professor of Steam Engineering, Emeritus. Professor Polson is author of a textbook entitled "Internal Combustion Engines" amd of two bulletins of the Engineering Experiment Station.

Horace James Macintire (B.S., 1905, Massachusetts Institute of Technology, M.M.E., 1911, Harvard University) served as a teacher in mechanical engineering at Massachusetts Institute of Technology, Harvard University, and the University of Washington, then became Assistant Professor of Refrigerating Engineering at the University of Illinois in September, 1920. He was made Associate Professor of Refrigeration in 1921 and Professor of Refrigeration in 1931, and has continued with the University to date. Professor Macintire is author of "Mechanical Refrigeration", "Principles of Mechanical Refrigeration", "Handbook of Mechanical Refrigeration", and "Refrigerating Engineering". In addition, he is co-author of four bulletins issued by the Engineering Experiment Station.

William Harrison Severns, (B.S., 1914, and M.S., 1915, University of Kansas) was Assistant at his alma mater during 1914-15, Instructor in Mechanical Engineering at Purdue University during 1915-16, Assistant Professor of Mechanical Engineering at New Hampshire State College during 1916-17, after which he joined the staff at the University of Illinois in September, 1917, as Instructor in Mechanical Engineering. He resigned in September, 1919, to engage in engineering practice following which he served as Assistant Professor of Mechanical Engineering at the University of Wisconsin during 1920-21. He then returned to the University of Illinois in September, 1921, as Assistant Professor. He became Associate Professor in 1927 and Professor in 1931, and has remained here to date (1945)

Professor Severns is author of a textbook "Heating, Ventilating, and Air-conditioning Fundamentals", and is co-author with Professor D. E. Degler of another text entitled "Steam, Air, and Gas Power", and is co-author with C. C. Hubbard of still another one entitled "Heating and Ventilating".

Carl Herbert Casberg (B.S., 1916, and M.E., 1924, University of Wisconsin) succeeded Gustav H.Radabaugh as Superintendent of the Mechanical Shops in September, 1923, with the title of Superintendent of the Machine Laboratory with the

rank of Assistant Professor of Machine Shop Practice, having been previously engaged in engineering practice since the date of graduation. Professor Casberg resigned his University position in September, 1926, to accept an appointment with the Western Electric Company in Chicago, as Engineer in the Development Division. In February, 1928, however, he returned to the University as Manager of the Shop Laboratories; and since 1931, he has been Professor of Mechanical Engineering in charge of all mechanical engineering shop laboratories and shop practice. He is co-author of four bulletins issued by the Engineering Experiment Station.

John Alonzo Goff (B.S., 1921, M.S., 1924, and Ph.D., 1927, University of Illinois) became Assistant in Mechanical Engineering at the University in September, 1921. He served as Instructor during 1923-25 and Associate during 1925-27. He resigned in September, 1927, to engage in engineering practice, but returned to the University in September, 1930, as Associate Professor of Thermodynamics. He became Professor of Thermodynamics in 1935, but resigned finally in September, 1938, to accept a position as Dean of the Towne Scientific School and Director of the Department of Mechanical Engineering and Whitney Professor of Dynamical Engineering, at the University of Pennsylvania.

William Nelson Espy (B.S., 1916, Carnegie Institute of Technology; M.S.,1927, University of Illinois) was engaged in engineering practice from 1916 to 1922 (September) when he came to the University as Assistant in Mechanical Engineering. He was made Instructor in 1923, Associate in 1928, Assistant Professor in 1930, Associate Professor in 1937, and Professor of Mechanical Engineering in 1939, which last position he has held to date.

Fred Ernest Giesecke (M.E., 1890, Agricultural and Mechanical College of Texas; B.S. in Arch.1904, Massachusetts Institute of Technology; Ph.D., 1924, and C.E. 1943, University of Illinois) was a teacher in Agricultural and Mechanical College of Texas from 1886 to 1912, and was Professor of Architectural Engineering and Director of the Bureau of Engineering Research at the University of Texas from 1912 to 1927. He then returned to the Agricultural and Mechanical College of Texas to become Professor of Engineering Research and to act as College Architect

and in addition, to serve as Director of the Engineering Experiment Station. In 1939, Professor Giesecke retired, becoming Professor Emeritus of Heating, Ventilating, and Air Conditioning there. In September, 1942, he came to the University of Illinois as Special Research Professor of Mechanical Engineering and remained here until December, 1943.

Maurice Kendall Fahnestock (B.S., 1924, and M.S., 1930, University of Illinois) was connected with practical engineering work from the time of graduation until he came to the University in April, 1926, as Special Research Assistant in Mechanical Engineering to aid in experiments involving cooperative investigations in steam and hot-water heating. He was made Special Research Associate in 1931, Special Research Assistant Professor in 1934, Special Research Associate Professor in 1939, and Research Professor in 1943. In addition, on September 1, 1943, he became Assistant Director of the Engineering Experiment Station. Professor Fahnestock is author of one bulletin and one reprint and is joint author of six bulletins and one reprint of the Engineering Experiment Station.

David Gerald Ryan - (B.S., 1923, and M.E., 1933, Purdue University; M.S., 1931, University of Illinois) followed engineering practice after graduation until he joined the staff at the University of Illinois in September, 1927, as Assistant in Mechanical Engineering. He became Instructor in 1929, Associate in 1933, Assistant Professor in 1935, Associate Professor in 1939, and Professor in 1943. He is co-author of one bulletin published by the Engineering Experiment Station.

Seichi Konzo (B.S., 1927, University of Washington; M.S., 1929, University of Illinois) was appointed Special Research Assistant in Mechanical Engineering at the University of Illinois in 1929, Special Research Associate in 1931, Special Research Assistant Professor in 1937, Special Research Associate Professor in 1941 and Research Professor in 1943. Professor Konzo's special field is in heating, ventilating, and air-conditioning; and he is co-author of thirteen bulletins and three circulars published by the Engineering Experiment Station.

Julian Robert Fellows (B.S., 1924, University of Michigan; M.S., 1933, University of Illinois) followed practical engineering work after graduation until he joined the staff at the University of Illinois in September, 1930, as Instructor in Mechanical Engineering. He was made Associate in 1934, Assistant Professor in 1939, Associate Professor in 1943, and Professor in 1945. Professor Fellows developed a new type of down-draft smokeless furnace for household use that practically eliminates the smoke problem so disagreeable in domestic heating. He is co-author of one bulletin, one circular, and one reprint of the Engineering Experiment Station.

Kenneth James Trigger (B.S., 1933, M.S., 1935, and M.E., 1943, Michigan State College) was made Associate in Mechanical Engineering at the University of Illinois in September, 1938, Assistant Professor in 1941, and Professor in 1945, his special interest being concerned with the heat-treatment of metals.

c. Associate Professors

Charles F. Perry (M.E., 1904, Cornell University) served as Associate Professor of Machine Construction here from 1904 to 1906.

Vincent Stephen Day (B.S., 1917, University of Illinois) became Assistant in Mechanical Engineering here in September, 1917, Research Assistant in 1918, Special Research Associate in April, 1920, Special Research Assistant Professor in 1921, and Special Research Associate Professor of Mechanical Engineering in 1926. He resigned in June, 1928, to engage in practical work. Professor Day's special interest was in heating, ventilating, and air-conditioning; and he is author of one bulletin and one circular, and co-author of four bulletins issued by the Engineering Experiment Station.

Matthew R. Riddell (B.A. Sc., 1906, University of Toronto) was Professor of Mechanical Engineering at the University of Toronto from 1906 to 1911, after which he was engaged in commerical work until he came to the University of Illinois in February, 1920, as Assistant Professor of Aeronautical Engineering and as Assistant to the Director of the Engineering Experiment Station. In 1929, he became Associate Professor of Aeronautical Engineering while still retaining his title as

Assistant to the Director. Professor Riddell reached the University age limit in September, 1945, and was retired with the title of Associate Professor of Mechanical Engineering, Emeritus.

Paul Eugene Mohn (B.S., 1922, and M.E., 1931, Pennsylvania State College; M.S. 1930, University of Illinois) was Instructor at Renneselear Polytechnic Institute during 1922-25. He became Instructor in Mechanical Engineering at the University of Illinois in 1925, serving in that capacity until 1928, then as Associate from 1928 to 1931, as Assistant Professor from 1931 to 1941, and as Associate Professor from 1941 to 1944. In September, 1944, he was promoted to the grade of professor, but declined the appointment to accept a position as Head of the Department of Mechanical Engineering at the University of Buffalo.

Albert Eby Hershey (B.S., 1922, Carnegie Institute of Technology; M.S., 1926, and Ph.D, 1942, University of Illinois) joined the staff at the University in September, 1926, as Research Assistant in Mechanical Engineering. He became Instructor in Mechanical Engineering in 1928, Research Associate in 1932, Research Assistant Professor in 1937, and Research Associate Professor in 1945. He is co-author of two bulletins published by the Engineering Experiment Station. He was given a leave of absence in January, 1942, to engage in war-production work with the Westinghouse Research Laboratories.

Reinhold Fridtjof Larson (B.S., 1923, M.S., 1931, and Ph.D., 1944, University of Illinois) took up practical work after graduation and continued in it until he joined the staff of the University of Illinois in September, 1927, as Assistant in Mechanical Engineering. He became Instructor in 1929, Associate in 1934, and Assistant Professor in 1937. Since 1945, he has had the title of Associate professor of Mechanical Engineering, his special interest being in the field of petroleum-production engineering.

Carl Edward Schubert (B.S. in Chem. Eng., 1921, University of Notre Dame) was engaged in engineering practice until he joined the staff of the University of Illinois in September, 1926 as Assistant Superintendent of the Foundry Laboratory. He

became Instructor in Mechanical Engineering here in 1931, Associate in 1932, Assistant Professor in 1939, and Associate Professor in 1945. He was given a leave of absence on September 1, 1944, to take a position in war work and returned to the University on February 1, 1945. Professor Schubert is author of a textbook entitled "Foundry Practice" and is co-author of three bulletins issued by the Engineering Experiment Station.

d. Assistant Professors

William H. Van Dervort (B.S., 1889, Michigan Agricultural College; M.E., 1893, Cornell University) served as teacher in the Department of Mechanical Engineering at Michigan Agricultural College during 1889-1893, and as Assistant Professor of Mechanical Engineering at the University of Illinois during 1893-1899.

Gerdt Adolph Gerdtzen (B.S., 1893, and M.E., 1895, University of Wis.), after some years' experience in engineering practice, came to the University of Illinois in 1901 as Assistant Professor of Machine Design, but resigned at the end of the academic year.

James Herbert Gill (B.M.E., 1892 and M.E., 1894, University of Minnesota) was engaged as a teacher of mechanical-engineering subjects in the University of Minnesota, Montana State College, and James Millikan University until he joined the staff at the University of Illinois in 1906 as Assistant Professor of Machine Construction in charge of the Mechanical Engineering Shops. He resigned in 1910 to accept a position as Director of the Columbus(Ohio) Training School.

Dwight T. Randall (B.S., 1897 and M.E., 1905, University of Illinois) was employed in engineering practice until 1901 when he came to the University as Instructor in Mechanical Engineering. He resigned in 1902 to work for the Westinghouse Church, Kerr & Company, but returned to the University in 1904 as Assistant Professor, and remained here until 1906, when he withdrew to re-enter commerical practice.

John Charles Thorpe(B.S., 1900, University of Illinois; M.E., 1903, University of Michigan) was engaged in teaching work and practical work after graduation until he came to the University in 1906 as Assistant Professor of Steam Engineering. He remained here until 1910, when he resigned to enter commercial service.

Mr.Thorpe died on June 17, 1937.

Kenneth Gardner Smith (A.B., 1896, University of Chicago; B.S., 1905, and M.E. 1916, University of Illinois) served in practice for a time, then came to the University of Illinois in 1908 as Assistant Professor of Mechanical Engineering in charge of Engineering Experiment Station Extension. He remained only one year, however, and left to become Assistant Professor in the Extension Division of the University of Wisconsin.

Elisha Noel Fales (A.B., 1908, Harvard University; S.B., 1911, Massachusetts Institute of Technology) spent several years in practical work in airplane service then came to the University of Illinois in September, 1916, as Assistant Professor of Aeronautics, and inaugurated instruction in the new science of aeronautical engineering. When the U.S. School of Military Aeronautics was organized at Illinois in 1917, Professor Fales was transferred to this new work and was in charge of cross-country flying and the general theory of aeronautics. In August, 1918, Professor Fales was requested to accept a position with the Aviation Section of the Signal Corps to engage in research work. In 1943, he was Aeronautical Engineer with the U. S. Air Corps at Wright Field, Dayton, Ohio.

Harry William Waterfall (B.S., 1911, Massachusetts Institute of Technology) spent the year following graduation in practice and came to the University of Illinois in September, 1913, as Instructor in Machine Design. He resigned in July, 1917, to accept a position in engineering practice in India. Mr. Waterfall returned to the University in September, 1919, as Assistant Professor of Mechanical Engineering, but withdrew in September, 1920, to become Assistant Professor of Machine Design at Johns Hopkins University.

Paul James Kiefer (A.B., 1908, Wittenberg College: B.S., 1911, and M.E.,1930, Case School of Applied Science) was Instructor in Mechanical Engineering at the University of Pennsylvania during 1913-15. He came to the University of Illinois in 1919, after being discharged from the U.S. Navy, as Assistant Professor of Steam Engineering. Professor Kiefer resigned in the summer of 1920 to become Associate Professor of Mechanical Engineering, Post Graduate Department, U. S.

Naval Academy, and since 1925, he has been Professor there.

Gustav H. Radebaugh became Assistant in Machine Shop at the University in 1911 and Instructor in 1913. He was made Associate in Machine Shop Management and Practice and Acting Director of the Shop Laboratories in September, 1917. In January, 1919, upon the return of Director B. W. Benedict from military service, Mr. Radabaugh was made Assistant Director of the Shop Laboratories, still keeping the title of Associate in Machine Shop Management and Practice. In September,1919 his title was changed to Assistant Manager of the Shop Laboratories and Superintendent of the Machine Shop; and in 1921, he was made Superintendent of the Machine Laboratory. Mr. Radabaugh resigned in February, 1923, to become Manager of the newly-created Champaign-Urbana Sanitary District, which position he held until his death on March 10, 1937.

Huber Ogilvie Croft (B.S., 1918, University of Colorado; M.S., 1923, University of Illinois) was engaged in engineering practice after graduation until he joined the staff at the University of Illinois in October, 1920, as Instructor in Mechanical Engineering. He became Associate in 1924 and Assistant Professor in 1925. Professor Croft resigned in September, 1927, to accept an appointment as Associate Professor at Stanford University. After three years there, he became Professor and Head of the Department of Mechanical Engineering at the University of Iowa, where he has remained to date. Professor Croft is author of one bulletin published by the Engineering Experiment Station of the University of Illinois.

Howard Edward Degler (M.E., 1914, Lehigh University; M.S., 1927, University of Illinois) was employed during 1914-15 in engineering practice and during 1915-19 ~~to 1919~~ taught drawing, physics, and mechanical engineering subjects at Hampton Institute in Virginia. He was connected with practical work again until September 1922, when he joined the staff of the University of Illinois as Instructor on Mechanical Engineering. He became Associate in 1925 and Assistant Professor in 1928. Professor Degler resigned in September, 1930, to become Professor of Mechanical Engineering and Chairman of the Department at the University of Texas. While at Illinois, Professor Degler was co-author with W. H. Severns of a textbook

entitled "Steam, Air, and Gas Power", and has written a number of others since that time.

Frederick Hayward Thomas (B.S. in Industrial Administration, 1924, and M.S. in M.E., 1931, University of Illinois) was employed in engineering practice after graduation until he joined the staff in the University here in November, 1926, as Superintendent of the Machine Tool Laboratory. He was made Associate in Mechanical Engineering in 1931, and Assistant Professor in 1932. He resigned in October 1941.

Warren Skinner Harris (B.S. 1930, and M.S., 1933, University of Illinois) served as Special Research Assistant in Mechanical Engineering here during the year 1931-32. He then took a position in industry, but returned to the University in April, 1940, as Special Research Associate in Mechanical Engineering, and became Special Research Assistant Professor in 1944. He is co-author of two bulletins and one circular of the Engineering Experiment Station.

John Clem Miles(B.S., 1931, Missouri School of Mines and Metallurgy; M.S., 1940, and M.E., 1943, University of Illinois) was made Instructor in Mechanical Engineering at the University here in 1937, Associate in 1941, and Assistant Professor in 1945. He is joint author of one bulletin of the Engineering Experiment Station.

Edward Louis Broghamer (B.S., 1934, Kansas State College; M.S., 1940 and M.E., 1941, University of Illinois) was made Instructor in Mechanical Engineering here at the University in 1937, Associate in 1941, and Assistant Professor in 1945. He received a leave of absence in September, 1942, to join the U.S. Armed Forces and returned to the University in November, 1945. Professor Broghamer is co-author of one bulletin of the Engineering Experiment Station.

Mario Joseph Goglia (M.E., 1937, and M.E., 1940, Stevens Institute of Technology) became Instructor in Mechanical Engineering at the University of Illinois in September, 1938, Associate in 1941, and Assistant Professor in 1945.

Donald Heathfield Krans (B.S., 1938, Michigan College of Mines and Technology; M.S., 1939, University of Wisconsin) became Instructor in Mechanical Engineering at the University here in September, 1939, Associate in 1941, and Assistant Professor in 1945. He was on leave of absence with the U.S. Armed Forces from 1941, until February, 1946.

e. Associates

John James Harman (B.S. 1902, and M.E. 1906, University of Illinois) served as Instructor in Mechanical Engineering during 1903-06 and as Associate during 1906-07.

John Adlum Dent (M.E. 1905, Lehigh University) was employed in engineering practice after graduation until he came to the University of Illinois in Sept., 1910, as Instructor in Mechanical Engineering. He was made Associate in 1913, and retained his position here until September, 1917, when he resigned to accept a commission in the U.S. Army.

Harry Frederick Godeke (B.S., 1905, M.E., 1916, and M.S., 1918, University of Illinois) was Assistant in Mechanical Engineering at the University during 1905-07, Instructor during 1906-17, and Associate in Steam Engineering during 1917-18. He resigned late in September, 1918, to accept a position as Chief Engineer of the Federal Rubber Company at Cudahy, Wisconsin.

Gustave Adolph Gross who had served as Instructor in Shop Practice at the University of Montana during 1911-13, came to the University of Illinois in 1913 as Instructor in Pattern Making. He became Associate in 1917, but resigned in February, 1918, to join the U.S. Ordnance Corps.

Arthur C. Harper (B.S. 1906, and M.E., 1907, Pennsylvania State College)

for

three years after graduation was a teacher at his alma mater. Then during 1910-16 he was Instructor in Drawing at Ohio State University. He joined the University of Illinois in January, 1916, as Instructor in Mechanical Engineering and was made Associate in Machine Design in 1917. He resigned in September, 1920, to take charge of drawing and design work at Pratt Institute. In 1931, he became President of Wyomissing Polytechnic Institute at Wyomissing, Pennsylvania, and has retained in that position to date.

Edgar McNaughton (M.E., 1911, Cornell University) was Associate in Mechanical Engineering at the University of Illinois during 1918-19.

Ward Ely Pratt (M.E., 1914, Cornell University) became Special Research Associate in Mechanical Engineering at the University of Illinois in 1918, and remained here in that position until 1920.

Siebert Luke Simmering (B.S., 1910, and M.E., 1916, University of Colorado; M.S., 1913, University of Illinois) was Research Associate in Mechanical Engineering here at the University of Illinois during the school year 1918-19.

Leroy Alonzo Wilson (M.E.1909, and M.M.E., 1914, Cornell University) for five years after graduation served as Instructor in the Mechanical Laboratory, in Gas Engine Design, and in Engineering Research at Cornell. He joined the University of Illinois in September, 1914, as Assistant in Mechanical Engineering. He became First Assistant in 1915 and Research Assistant in 1916, but resigned in September, 1917, to become Instructor in the U.S. School of Military Aeronautics. Mr. Wilson then returned to the University of Illinois in December, 1918, as Research Associate in Mechanical Engineering. He was transferred to the teaching staff in 1919 with the title of Associate in Experimental Engineering. He resigned, however, in September, 1920, to accept a position as Assistant Professor of Mechanical Engineering at the University of Cincinnati. Since 1938, he has been Professor of Mechanical Engineering at the University of Wisconsin. Professor Wilson is joint author of one bulletin published by the Engineering Experiment Station at the University of Illinois.

Proctor Edwin Henwood (B.S., 1910, Armour Institute of Technology; M.S.,1933 University of Illinois) served as teacher at the University of North Dakota for a

time after which he was engaged in engineering practice until he came to the University of Illinois in September, 1921, as Associate in Mechanical Engineering. He remained in this position until his death on May 29, 1938. Mr. Henwood was co-author of one bulletin of the Engineering Experiment Station.

Edward Jameson Crane (B.S., 1915, and M.E., 1921, Rutgers University) was employed after graduation at the University of Porto Rico, and later spent some time in engineering practice. He came to the University of Illinois in September, 1921, as Instructor in Mechanical Engineering and was made Associate in Machine Design in 1923. Mr. Crane resigned in February, 1925, to accept an appointment with the Western Electric Company. He was co-author with C.W. Ham of a textbook entitled "Mechanics of Machinery".

Crandall Zacariah Rosecrans (B.S. 1919, M.S. 1921, and M.E. 1929, University of Illinois) joined the University of Illinois staff in September, 1921, as Research Assistant in Mechanical Engineering and was made Research Associate in 1924. He author of one and co-author of two more bulletins issued by the Engineering Experiment Station. Mr. Rosecrans resigned in August, 1926, to accept an appointment with the Leeds & Northrup Company at Philadelphia. He later became Mechanical Engineer and Director of Research of that organization, which position he held until his death on January 7, 1937.

Lew Wallace Thayer (B.S. in Chem.Eng., 1922, University of Michigan) became Associate in Foundry Practice in September, 1926, after spending four years with the Cadillac Motor Car Company. He resigned his University position in July, 1928.

Richard Ernest Gould (B.S., 1923, and M.S., 1929, University of Illinois) was engaged for two years following graduation in engineering practice. He joined the staff of the University of Illinois in December, 1925, as Research Assistant in Mechanical Engineering. In 1929, he became Research Associate, but resigned in September, 1930, to return to engineering practice. Mr. Gould was joint author of five bulletins published by the Engineering Experiment Station.

Edgar Thomas Lanham became Instructor in the Forge Shop at the University of Illinois in 1905, and he retained that title until 1919, when it was changed to Superintendent of the Forge Laboratory. He was made Associate in Mechanical

Engineering in 1931, and was retired under the University age rule in September, 1933, as Associate in Mechanical Engineering, Emeritus. He continued to reside in Urbana until his death on June 10, 1944.

Burrill Rupert Hall who had spent several years with the International Correspondence Schools at Scranton, Pennsylvania, in charge of the preparation of instruction sheets and pamphlets in pattern-making for students carrying on correspondence courses, came to the University of Illinois in February, 1918, as Instructor in Pattern Shop Practice and Management. In 1919, his title was changed to Superintendent of the Pattern Laboratory. Mr. Hall remained in this position until September, 1931, when he became Associate in Mechanical Engineering. He retired in September, 1938, under the University rules for retirement with the title Associate in Mechanical Engineering, Emeritus.

John Frank Woodell (A.B., 1925, Ohio State University; M.S., 1926, Vanderbilt University) served as Superintendent of the Foundry Laboratory at the University of Illinois from 1929 to 1931, and as Associate from 1931 to 1942. He was given a leave of absence in September, 1942, to join the U.S. Armed Forces.

John Clifford Reed (B.M.E. 1928, and M.E. 1934, Ohio State University; M.S. 1931, University of Illinois) became Assistant in Mechanical Engineering at the University of Illinois in September, 1928, Instructor in 1929, and Associate in 1933. He remained with the University until September, 1938, when he resigned to become Head of the Department of Mechanical Engineering at the Colorado School of Mines.

Edgar Elmer Ambrosius (B.S. 1928 and M.S. 1931, University of Illinois) began as Instructor in Mechanical Engineering at the University in September, 1930, and was made Associate in 1933. He resigned in September, 1936, to become Assistant Professor of Mechanical Engineering at the University of Oklahoma.

Charles Joseph Starr (B.S. 1933, University of Illinois) after spending several years in practice, joined the University staff in March, 1921, as Assistant Superintendent of the Machine Laboratory. He was made Instructor in Mechanical Engineering in 1931, and Associate in 1934, and has remained with the University in that position to date.

Paul Howard Black (M.E. 1925, Rennselear Polytechnic Institute; M.S. 1931, University of Pittsburgh) served as Instructor in Mechanical Engineering at Rennselear during 1925-26 and was engaged in engineering practice during 1926-28. He came to the University of Illinois in September, 1928, as Assistant in Mechanical Engineering. He was made Instructor here in 1929 and Associate in Mechanical Engineering in 1934. Mr. Black resigned in September, 1937, to become Assistant Professor of Machine Design at Cornell University and has remained there to the present time. He was author of one bulletin issued by the Engineering Experiment Station.

Robert Downes Williams (A.B. 1934, Harvard University; S.M. 1937, Massachusetts Institute of Technology) was made Associate in Mechanical Engineering in 1937 and remained with the University in that position until February, 1942.

Francis Seyfarth (B.S. 1936, Princeton University; M.S. 1942, University of Illinois) became Instructor in Mechanical Engineering here in September, 1938, and Associate in 1942. He was given a leave of absence in December, 1942, to join the U. S. Armed Forces, and returned in March, 1946.

F. Leicester Cuthbert (B.A. 1935, and M.A. 1937, University of Buffalo; Ph.D. 1940, Iowa State College) became Special Research Associate in Petrography and Mechanical Engineering at the University of Illinois in September, 1942, and remained with the University until March, 1944

Alfred Otto Schmidt (M.E. 1938, Ingenieurschule, Ilmenau, Germany; M.S.E., 1940, University of Michigan) became Associate in Mechanical Engineering in September, 1942, but resigned in June, 1943, to engage in engineering practice.

William Hubert Allaway (B.S. 1938, University of Nebraska; M.S. 1939, Iowa State College) served as Special Research Associate in Mechanical Engineering and Petrography at the University of Illinois from January to September, 1943.

John Adams Henry (B.S. 1930, Michigan State College) joined the staff at the University of Illinois in February, 1941, as Instructor in Mechanical Engineering and served in that capacity until September, 1944, when he was promoted to Associate.

David Herold Cole (B.S., 1941, University of Illinois; M.S. 1940, University of Michigan) served as Instructor in Mechanical Engineering here from September, 1941, to September, 1944, at which time he was made Associate in Mechanical Engineering.

Cyrus Dale Greffe (B.S. 1940, University of Illinois) was Instructor in Engineering Drawing at the University of Louisville from September, 1940, until September, 1942, when he joined the staff at the University of Illinois as Instructor in Mechanical Engineering. He was made Associate in 1944.

f. Instructors and Research Assistants

Alexander Thompson (C.E. 1867, University of Michigan) served as Foreman of the Machine Shop at the University of Illinois during the year 1870-71, at the end of which time he resigned to accept a teaching position at the University of Iowa.

Elna Alphono Robinson (B.S. 1875, and Hon. M.E., 1893, University of Illinois) who was a brother of Professor S. W. Robinson, and who had served a four-year apprenticeship as a machinist, had worked seven years as a journeyman, had been foreman for three years of a machine shop in Janesville, Wisconsin, and had enrolled in the University here in the mechanical-engineering curriculum in 1870, became Foreman of the Machine Shop in 1871. He was skillful and energetic as a mechanic, ingenious and resourceful in devising ways and means of doing work, and tactful and successful in stimulating workmen of their best endeavors. He remained with the University as Foreman of the Shop until 1877, when he resigned to engage in industrial and commercial work in Champaign. He died in Champaign on March 31, 1921.

Edward Alonzo Kimball served as Foreman of the Machine Shop here from 1877 to 1885, and as Instructor in Iron Work and Foreman from 1885 to 1889. He died on November 14, 1898.

Rufus Anderson (B.M.E. 1873, and M.E. 1882, Cornell University) served as Instructor in Iron Work and Foreman of the Foundry at the University of Illinois from 1889 to 1893. He resigned to enter engineering practice, and died on May 10, 1917.

John Victor Emmanuel Schaeffer (B.S. 1888, and M.S. 1905, University of Illinois) was Instructor in the Machine Shop here during 1889-90, after which he was engaged in engineering practice. In 1907, he organized the Schaeffer Manufacturing Company, and still later became a member of the Roberts and Schaeffer Company, Chicago. While he was a student, Mr. Schaeffer was a member of the Philomathaen Literary Society and took an active interest in debating, representing his Society in many inter-society oratorical contests. His interest in this connection led him to establish the Schaeffer prize fund here at the University as a basis for awards to engineering students in essay contests, described later in this publication.

Edward Spencer Keene (B.S. 1890, and M.E. 1912, University of Illinois) served as Instructor in Mechanical Engineering here from 1890 to 1892, after which he

resigned to become Professor of Mechanical Engineering at North Dakota Agricultural College. He was made Dean of Engineering there in 1904, and retained that position until his death on August 12, 1928.

Cyril B. Clark served as Foreman in the Machine Shop during 1892-1901.

Henry T. Jones became Instructor in the Forge Shop in 1893 and remained with the University until 1905.

Albert Root Curtis served as Instructor in the Wood Shop at Michigan Agricultural College from 1890 to 1893, then held the same position at the University of Illinois from 1893 to 1906.

Robert Alvin Wood (B.E. 1894, and M.E. 1895, University of Illinois) was Instructor in Mechanical Engineering here at the University from 1894 to 1896, when he resigned to take up service with the U.S. Bureau of Mines.

Joseph H. Wilson, served as Instructor in the Foundry from 1895 to 1905.

William Harrison Kavanaugh (M.E. 1894, Lehigh University) spent the three years following graduation in engineering practice and commercial work, then served as Instructor in Mechanical Engineering at the University of Illinois during the school year 1897-98.

Edd Charles Oliver (B.S. 1898, Purdue University) became Instructor in Mechanical Engineering at the University of Illinois in 1898 and remained here until 1902, when he resigned to accept an appointment at the University of Minnesota.

David Leonard Scroggin became Instructor in the Machine Shop at the University of Illinois in 1901, and held this position until 1914, when he resigned to engage in commercial work.

David Carroll Veirs (B.S. 1901, University of Illinois; M.E. 1907, University of Nebraska) served as Instructor in Mechanical Engineering at the University here during 1901-03, then went into engineering practice. Later he served as Assistant professor of Machine Design during 1906-07 at the University of Nebraska.

William Alexander Gordon Fraser (B.S. 1899, University of Illinois) was engaged in commercial practice until he came to the University in 1901 as Instructor in Mechanical Engineering. He retained his position with the University until

1903, when he withdrew to re-enter engineering work.

Edwin Gardner Greenman (B.S. 1902, and M.E. 1907, University of Illinois) served as Instructor in Mechanical Engineering here during 1902-03, after which he withdrew to accept a position at the University of Cincinnati.

Robert Hayden Kuss (B.S. 1903, University of Illinois) was Instructor in Mechanical Engineering here from 1903 to 1905, when he left to engage in engineering practice.

Claude Mallory Garland (B.E. 1903, Vanderbilt University) followed engineering practice after graduation until he joined the staff at the University of Illinois in 1905 as Instructor in Mechanical Engineering. He held this position until 1910, when he resigned to re-enter engineering practice. Mr. Garland is joint author of three bulletins of the Engineering Experiment Station.

William Van Dunkin (B.S. 1903 and M.E. 1909, University of Illinois) was engaged in engineering practice from date of graduation until he came to the University in 1905 as Instructor in Machine Design. He continued in his position here until July, 1912, when he withdrew to re-enter commercial practice.

William Watson served as Instructor in Foundry at the University here during 1905-06.

Robert Cleyton Matthews (see General Engineering Drawing) was Instructor in Mechanical Engineering here during 1905-06.

Frederick Ellis became Instructor in Pattern Making in September 1906, and retained that position until August, 1913, when he resigned to accept an instructorship in a newly-organized trade school at Edmonton, Alberta.

Alfred Rittscher Bench (B.S. 1906, University of Illinois) was Instructor in Mechanical Engineering here from 1906 to 1910, when he left to engage in engineering practice.

Shields Quitman Casper, after several years of experience as a professional iron moulder, became Instructor in the Foundry at the University of Illinois in 1906, where he remained until 1910, when he resigned to engage in the real-estate business in Champaign.

Frank Lyman Busey (B.S. 1895, and M.E. 1898, University of Illinois) was engaged in commercial work after graduation until he joined the staff at the University here in 1907 with the title of Research Assistant in Mechanical Engineering. He remained in this position until 1911, when he resigned to re-enter industrial work, which he followed until his death in 1914.

Allen Burton Cooke (B.S. 1907, University of Illinois) came to the University of Illinois in 1908 as Research Assistant in Mechanical Engineering. He resigned in 1909 to become a county agricultural agent in North Dakota.

Henry Bernard Dirks (B.S. 1904, and M.E.1905, University of Illinois) served as Assistant in Mechanical Engineering here during 1905-08 and as Instructor in Mechanical Engineering during 1908-10. He resigned in December, 1910, to accept a position in practical work. Later he became Professor of Mechanical Engineering at Michigan State College and still later Dean of Engineering there. While at Illinois, Mr. Dirks served as co-author of two bulletins issued by the Engineering Experiment Station.

Jean Paul Clayton (B.S.1909, Tulane University; M.E. 1911, University of Illinois) served as Research Assistant in Mechanical Engineering at the University of Illinois during 1909-11, and is the author of two bulletins issued by the Engineering Experiment Station. He resigned in 1911 to take up engineering practice. He was Vice-President of the Central Illinois Public Service Company during 1919 and 1930, President during 1932 and Chairman of the Board during 1932-33. He was, also, Assistant to the President of the Super-Power Company of Illinois during 1928-32, and Vice-President of the Middle West Utilities Company in 1932. Since 1932, Mr. Clayton has been Chief System Officer of the Commonwealth Edison Company, Public Service Company of Northern Illinois, Western United Gas and Electric Company, Illinois Northern Utilities Company, and of the Chicago District of the Electric Generating Corporation.

Alwin Louis Schaller (B.S. 1907, and M.E. 1912, University of Illinois) served as Instructor in Mechanical Engineering during 1909-11.

Paul Wright Gawne (B.S. 1909, Purdue University) served as Assistant and

Instructor in Woodshop and Foundry at the University of Illinois in charge of the foundry during 1909-12. He resigned to become a teacher in manual training in secondary-school work.

James Charles Lund (B.S. 1909, University of Illinois) served as Instructor in Metal Working from October, 1909, to July, 1910.

Perry John Freeman (B.S.1907, and M.E.1916, University of Illinois) served for three years as Instructor in Mechanical Engineering at the University of Pennsylvania, then came to the University of Illinois in September, 1910, as Instructor in Machine Construction and in charge of the Mechanical Engineering Shops. He resigned in February, 1912, to engage in practical work.

Robert Edwin Kennedy attended the University of Illinois during 1909-10, and became Instructor in Foundry Practice in 1910, remaining until 1917, when he resigned to enter military service. He returned to the University in September, 1919, as Superintendent of the Foundry Laboratory, but left again in September, 1921, to become Secretary of the American Foundryman's Association. He rejoined the staff at the University again in September, 1922, as Superintendent of the Foundry Laboratory, but left finally in September, 1924.

John N.Vedder (A.B. 1895, and A.M. 1897, Union College) was engaged for several years in engineering practice and joined the University staff here in September, 1910, as Research Assistant in Mechanical Engineering. He resigned in September, 1914, to become Assistant Professor of Thermodynamics at Union College Mr. Vedder is joint author of one bulletin issued by the Engineering Experiment Station here.

Archie Stanton Buyers (B.S. 1908, University of Illinois) became Instructor in Mechanical Engineering here in September, 1911, but resigned in December, 1912, to accept an appointment in the U.S.Coast Artillery.

Herbert Seton Eames (B.S. 1908, Massachusetts Institute of Technology) served as Assistant in Physics at Massachusetts Institute of Technology for a year after graduation, then became Instructor in Mechanical Engineering at Rhode Island State College. After three years there, he became Instructor in Mechanical

Engineering here at the University in September, 1912, remaining here until September, 1914, when he resigned to accept the editorship with "Ice and Refrigeration" in Chicago.

Brainerd Mitchell, Jr. (B.M.E.1907 and M.E.1911, University of Arkansas) was for a number of years Instructor and later Associate Professor at his alma mater. He became Instructor in Machine Design at the University of Illinois in September, 1912, but withdrew in June, 1913, to assume the position he formerly held at the University of Arkansas.

Arthur Boquer Domonoske (B.S. 1907, and M.S. 1909, University of California) after serving for three years at his alma mater, was made Instructor in Machine Design at the University of Illinois in September, 1913. He resigned in August, 1915, to enter commercial work. Later, he became Head of the Department of Mechanical Engineering at Stanford University.

Joseph Culpeper Pendleton was Assistant in the Foundry at the University during 1912-13, and Instructor during 1913-14. He resigned in September, 1914, to enter commercial practice.

Frederick Calkins Torrance (M.E. 1911, Cornell University) spent the first two years after graduation in engineering practice, then joined the University of Illinois as Instructor in Mechanical Engineering in September, 1913. He resigned in August, 1915, to re-enter engineering practice.

Horatio Sprague McDewell (S.B. 1907, and M.M.E. 1908, Harvard University) became Instructor in Mechanical Engineering at the University of Illinois in 1914, after having spent several years in practice. He resigned his position here in April, 1917, to accept an appointment as Engineer of Tests with the U.S.Navy.

Edwin Diederich August Frank (B.S. 1906, Massachusetts Institute of Technology) spent some years in practice and study at home and abroad after graduation then served as Instructor in Mechanical Engineering at the University of Illinois during 1914-17, resigning in February, 1917, to engage in practical engineering work.

James Harvey Hogue who had had several years of practical experience in

foundry work, became Instructor in Foundry Practice at the University of Illinois in September, 1914. He remained in this position until the summer of 1918, when he resigned to engage in commercial work.

Jeremian Amos De Turk (B.S. 1912, Pennsylvania State College) joined the staff at the University of Illinois in September, 1914, as Instructor in Machine Shop Practice. He resigned in January, 1918, to join the military service. He is the author of a textbook entitled "A Manual of Machine Shop Practice and Management".

George Benjamin Rice who was graduated from the U.S. Naval Academy in 1892 and who had spent several years in federal work, served as lecturer on mechanical equipment of buildings and as mechanical engineer in the office of Supervising Architect at the University during 1915-16. He resigned in May, 1916, to accept a position with a large chemical manufacturing company at Buffalo, New York.

Raymond Elder Robinson (B.S. 1908, and M.S. 1909, University of Illinois) was engaged in engineering practice after graduation until February, 1916, when he joined the staff at the University here as Instructor in Mechanical Engineering. He came for the second semester only at the urgent request of the department head to fill an appointment temporarily until some one could be secured to take it permanently. He returned to engineering work following his term at the University.

Claude Lowell Harrell (B.S. 1914, Purdue University) became Instructor in Mechanical Engineering at the University of Illinois in October, 1916, after spending two years in practical work following graduation. He resigned in the summer of 1917 to enter military service.

Cleon E. Phelps (B.S. 1913, Worcester Polytechnic Institute) joined the staff at the University of Illinois in March, 1917, as Assistant to the Director of the Shop Laboratories and Instructor in Shop Management. He resigned, however, in January, 1918, to enter military service.

Frank Gustave Wahlen (B.S.1917, Tufts College; M.S. 1919, University of Illinois) served as Research Assistant in Heating and Ventilation at the University of Illinois during 1917-19.

Francis Ames Hobart was made Instructor in Machine Shop Management in

September, 1918, but resigned at the end of the school year.

Hussein Halouk Fikret (B.S.E. 1916, University of Michigan) served as Instructor in Mechanical Engineering at the University of Illinois from September, 1918, until June, 1920, when he resigned to engage in engineering practice.

Peter J. Rebman became Assistant in the Forge Shop in 1910 and Assistant Superintendent of the Forge Shop in 1919. He resigned in February, 1920.

John Grennan, who had spent several years in practice in foundry work, was appointed Instructor in Foundry Practice and Management in February, 1918. His title was changed to Assistant Superintendent of the Foundry Laboratory in September, 1919, but he withdrew in the summer of 1920 to become Foundry Instructor at Camp Grant, Rockford, Illinois.

Roswell M. Rennie, (B.S. 1916, Massachusetts Institute of Technology) after several years' experience in practice, joined the staff of the University of Illinois in October, 1919, as Superintendent of the Machine Shop. He resigned, however, at the end of the year to engage in commercial work.

Oscar William Schricker, who was graduated from the Rankin School of Mechanic Trades of St. Louis, was made Assistant Superintendent of the Machine Laboratory in October, 1919, and retained that position until September, 1926.

Amos David Wright became Assistant Superintendent of the Pattern Shop at the University of Illinois in 1919. In 1931, his title was changed to Instructor in Mechanical Engineering, and has retained that position to date.

Roy Wilbur Schroeder was Assistant Superintendent of the Foundry Laboratory from September, 1920, to September, 1926.

Charles Nathan Arnold (B.S. in E.E., 1911, and M.S. in M.E., 1924, University of Illinois) became Instructor in Mechanical Engineering at the University here in February, 1921, after several years of practical experience in engineering work, and retained that position until June, 1925.

Arthur Hildeman Aagaard (B.S. 1914, University of Illinois) served several years as Instructor in Mechanical Engineering at the University of Wisconsin and Rice Institute, after which he was engaged in commercial work. He came to the

University of Illinois in February, 1921, as Instructor in Mechanical Engineering, but resigned at the end of the school year.

Glen N. Crosby, after graduating in Manual Training at the Western State Normal School, Kalamazoo, Michigan, came to the University of Illinois in February, 1921, as Assistant Superintendent of the Foundry Laboratory, where he remained until his death on March 31, 1923.

George Theodore Felbeck (B.S. 1919, and M.S. 1921, University of Illinois) joined the staff of the University here in September, 1921, as Research Assistant in Mechanical Engineering, and remained here until September, 1923. He is joint author of two bulletins published by the Engineering Experiment Station.

Frank Whitcher Martin (B.S. in M.E. 1920, George Washington University) was transferred from the Department of General Engineering Drawing at the University of Illinois to the Department of Mechanical Engineering in September, 1921, with the title of Instructor in Mechanical Engineering, but resigned in June, 1922.

John Dallas Wise (B.S. in E.E., 1915, Mississippi A.& M. College) was engaged for some time after graduation in engineering practice, then joined the U.S.Army. Following his discharge, he entered engineering practice again, but left it to come to the University in September, 1921, as Superintendent of the Foundry Laboratory. He remained here until September, 1922.

Russell James Englehart, after some years' experience in engineering practice, came to the University of Illinois in September, 1921, as Assistant Superintendent of the Forge Laboratory, and remained in that position until October, 1923.

Andrew John Nicholas (M.E. 1919, Lehigh University) served for a time as Instructor at Lehigh and for a time in engineering practice, after which he came to the University of Illinois in September, 1921, as Instructor in Mechanical Engineering. He withdrew in June, 1923.

John Patrick Mullen (B.Eng., 1917, and B.Eng.Hons., 1920, Liverpool University) was Research Assistant in Refrigeration at the University of Illinois from October, 1921, to September, 1925.

John Babcock Baker (B.S. in Chemical Engineering, 1921, and M.S. 1924,

University of Illinois) was Research Assistant in Mechanical Engineering here from September, 1923, to August, 1926. He is joint author of one bulletin of the Engineering Experiment Station.

Austin Sinclair Irvine (B.Ch.E., 1914 and M.S., 1915, University of Michigan) was engaged in engineering practice from 1915 to February, 1924, when he joined the staff at the University of Illinois as Assistant Superintendent of the Forge Laboratory, which position he held until September, 1926.

Tondering C. Barnhill (Stoberi Tekniker, 1917, Copenhagen Institute of Technology; F.M. and O., 1923, Wentworth Institute, Boston) had been employed in commercial foundry work before coming to the University in October, 1924, as Assistant Superintendent of the Foundry Laboratory. He remained here until 1929.

Clarence H. Caughey (B.S., 1921, and M.E., 1925, University of Colorado) served as Instructor in Mechanical Engineering at the University of Colorado after graduation until he became Instructor at the University of Illinois in September, 1925. He remained here, however, only until July, 1926.

Harry O. Haughton (Ph.B., 1919, Sheffield Scientific School, Yale University) was engaged in engineering practice after graduation until he joined the staff at the University of Illinois in September, 1923, as Assistant Superintendent of the Foundry Laboratory. He was made Superintendent of the Laboratory in 1925, but resigned in September, 1926.

John Houston Parker (B.S. 1922, University of Illinois) Assistant in Mechanical Engineering from 1923 to 1925, was promoted to Instructor in Mechanical Engineering in September, 1925. He remained here until June, 1927.

Gustaf Adolph Gafvert (B.S. 1923, and M.S., 1925, Worcester Polytechnic Institute) became Assistant in Mechanical Engineering at the University of Illinois in September, 1925, and Instructor in 1926, but withdrew in June, 1927.

Milton Oliver Wingard (B.E., 1925, Johns Hopkins University) served as Instructor in Mechanical Engineering at the University of Illinois from January, 1927, to September, 1928.

Lucius Duke Golden (B.S., 1926, University of Texas) joined the staff as Instructor in Mechanical Engineering at the University of Illinois in September,

1927, after teaching a year at his alma mater. He left the University in 1928.

Joseph Gibson Lowther (B.S. 1927, University of Texas; M.S. 1931, University of Illinois) was Research Assistant in Mechanical Engineering at the University of Illinois from 1928 to 1932. He is co-author of two Bulletins of the Engineering Experiment Station.

William Henry Spencer (B.S., in Chem Eng.1926, Vanderbuilt University) served as Superintendent of the Foundry Laboratory at the University of Illinois from July, 1928, to September, 1929.

John Fred Quereau (B.S., 1926, University of Texas; M.S., 1928, University of Illinois) was employed as Special Research Assistant in Mechanical Engineering from September, 1928, to September, 1929. He is joint author of one circular of the Engineering Experiment Station.

John Robert Connelly (B.S., 1927, and M.S., 1929, University of Illinois) served as Special Research Assistant in Mechanical Engineering from April to September, 1929.

Wilbur John Woodruff (M.S., 1923, Massachusetts Institute of Technology)served as Special Research Assistant in Mechanical Engineering from April, 1929, to April, 1930.

Edwin Laurence Broderick (B.S. 1923, Iowa State College; M.S., 1933, University of Illinois) was Special Research Assistant in Mechanical Engineering at the University of Illinois from September, 1930, to May, 1941. He is joint author of two bulletins of the Engineering Experiment Station.

Jack Philip CoVan (B.M.E., 1935, Ohio State University, M.S., 1942, University of Illinois) served as Instructor in Mechanical Engineering here from September, 1937, to June 1943, when he resigned to engage in engineering practice.

Charles Thoren Grace (B.S. 1936, University of Colorado; M.S. 1941, University of Illinois) served as Instructor in Mechanical Engineering here from September, 1937, to June, 1942.

Warren Eugene Compton (B.S. 1933, and M.S. 1934, University of Illinois) was employed as Instructor in Mechanical Engineering at the University of Illinois

from September, 1937, to November 1940.

Edwin Devere Luke (B.S. 1937, M.S. 1938, University of Illinois) was Instructor in Mechanical Engineering here from September, 1938, to September, 1941, when he was given a leave of absence to enter military service. He returned to his University duties in February, 1946.

Jay Arthur Bolt (B.S. 1934, Michigan State College; M.M.E., 1937, Chrysler Institute of Englnd) was Instructor in Mechanical Engineering at the University of Illinois from September, 1938, to October, 1940.

Sam Sachs (B.S. 1939, and M.S. 1942, University of Illinois) has served as Research Assistant from September, 1939, to date. He was granted a leave of absence on January 16, 1944, to join the U.S. Army.

Ross J. Martin (B.S. 1940, Michigan State College) became Special Research Assistant in Mechanical Engineering at the University of Illinois in July, 1940. He was on leave of absence for service with the U.S. Navy from September, 1942, until January, 1946. He is co-author of one bulletin of the Engineering Experiment Station.

Richard Bott Engdahl (B.S. 1936, Bucknell University; M.S., 1938, University of Illinois) became Special Research Assistant in Mechanical Engineering at the University of Illinois in February, 1939. His title was changed to Instructor in Mechanical Engineering in October, 1940; and he remained in that position until July, 1941. He is co-author of one bulletin of the Engineering Experiment Station.

Paul Stuart Collier (B.S. 1939, and M.S. 1941, Purdue University) became Instructor in Mechanical Engineering in September, 1941, and remained with the University until September, 1944.

Vernon Morris Korty (A.B. 1937, Illinois College; A.M. 1939, University of Illinois) was special Research Assistant in Mechanical Engineering at the University of Illinois from September, 1941, to June 1942.

Morse Beryl Singer - who had spent some time in practice with industrial firms and who had served for several years here as Assistant in Mechanical Engineering, was made Instructor in Mechanical Engineering in September, 1945.

Chester Edward Derrough, after several years' experience in practice and as Assistant in the Machine Laboratory here, became Instructor in Mechanical Engineering in September, 1945.

I. SUMMARY

General - Mechanical Engineering was the first department to be established in what is now the College of Engineering, and it has continued to be one of the major units. It has always had a relatively large enrollment of students and therefore has had to maintain a large teaching staff and an elaborate assortment of equipment most of which has been expensive in its first cost and operation. While the Department has sought to keep its teaching program in line with advancements in practice in the several fields of its endeavor, it has limited its instructional work to a single curriculum with a liberal allowance of optional subjects, and has left specialization to the graduate years. Its instructional objectives have at times seemed a little severe, but they have so operated to ground the students in the fundamental principles of engineering practice as to enable them to go into all branches of industry and serve there as a credit to themselves and the University.

Aside from its educational value to students enrolled in engineering courses, the laboratory equipment has served many useful purposes in the conduct of research. It has enabled the staff to provide materials for the publication of a long list of bulletins issued from time to time by the Engineering Experiment Station, that have gone far in establishing principles that have resulted in the development of this branch of industry. Much of the experimental work has been done in cooperation with commercial firms or scientific associations interested in these particular fields; and like all such cooperative effort, it has brought to the campus many persons of responsibility and influence, and thereby enabled the University and industry to establish mutual relations that cannot be reckoned in money values for any of the parties interested.

CHAPTER VIII

THE DEPARTMENT OF CIVIL ENGINEERING

A. ORGANIZATION

General - While the report of the original committee of the Regent and four Trustees in 1867 made provision for Civil Engineering in the Polytechnic Department, it took a little time to get the department organized. In the Catalogue and Circular of the University for 1868-69 under officers and instructors and their titles, is listed the position of Civil and Rural Engineering. No one had been appointed, apparantly, to fill this chair, however, for the name was left blank. In the 1869-70 issue, Samuel Walker Shattuck's name appears as Professor of Civil Engineering and Instructor in Military Tactics. In the 1870-71 number, the faculty list under the College of Mechanics and Engineering contains the names of S. W. Shattuck, Professor of Mathematics, and Alex. Thompson, Teacher of Railroad Engineering. In the Report of the Board of Trustees for 1870-71[1] appears the following statement: "The department of Civil Engineering has also won some laurels under the efficient management of Professor Shattuck and his assistants. Classes have been trained in both theory and field practice, and the services of some of the students have already been sought by outside parties, in engineering work". The organization of the Department or School as it was sometimes called, must have been somewhat nebular at that time, though, for the Catalogue contained a four-year course of studies "recommended" for the School to follow. Professor Robinson, Head of the Department or School of Mechanical Science and Engineering, directed instruction in civil engineering from March, 1870, when Professor Shattuck was obliged to give his entire attention to other matters, until November, 1871, when John Burkitt Webb, became Professor of Civil Engineering and Head of the Department. The appointment of Professor Webb to fill the chair of civil engineering served very definitely to establish the department as a separate entity with a required course of study for its instructional program.

B. OBJECTIVES AND METHODS OF INSTRUCTION

Objectives - The objectives of instruction in civil engineering were stated

1 Page 69

in various publications issued at different times by the University, as follows:

"This school is designed to make good practical Engineers, thoroughly prepared for all branches of Engineering work, Railroad surveys, Topographic and Geodetic Surveying, Bridge building, Government Surveying, etc. Several of the students, though not yet through their course, have already been honored with positions on the Coast Survey, and on important Railroads",[1]

"The School is designed to furnish a course of theoretical instruction accompanied and illustrated by a large amount of practice, which will enable students to enter intelligently upon the various and important duties of the Engineer. Those who desire a preparation, at once broad and thorough, and who are willing to make persevering effort to obtain it, are cordially invited to connect themselves with this School".[2]

"While the instruction aims to be practical by giving the student information and practice directly applicable to his future professional work, the prime object is the development of the mental faculties. The power to acquire information and the ability to use it, is held to be of far greater value than any amount of so-called practical acquirements".[3]

"The curriculum in civil engineering affords specialized training in the construction and maintenance of highways, in irrigation, drainage, and the reclamation of land, and gives general consideration to hydro-economics. It emphasises structural engineering, including the theory, design, and construction of masonry, reinforced-concrete and steel bridges, viaducts, buildings, and other structures".[4]

"The courses in the Department of Civil Engineering offer a systematic training in the principles underlying the design and construction of bridges, buildings, dams, retaining walls, and similar structures; of highways; of water-supply and sewage-disposal systems; and of hydraulic engineering works; and in the principles of city and regional planning".[5]

Methods of Instruction - "The method of instruction consists in coupling the development of intellectual power with the acquisition of information useful to the civil engineer in his profession".

"The instruction is given by lectures textbooks and reading, to which are added numerous problems and practical exercises, as will serve best to explain principles completely and fix them in the mind. Models and instruments are continually used, both in lectures and by the students themselves".[6]

C. ROOM ASSIGNMENTS FOR OFFICE, RECITATION, AND DRAFTING PURPOSES

General - The first quarters occupied by the Department of Civil Engineering for office, class, and drafting purposes were in Old University Building. Then, the Department moved into University Hall when that building was finished in 1873. When Engineering Hall was completed in 1894, the Department took over a portion of the second floor for offices, recitation, and drafting purposes -- the Department office being in Room 203. The Department also had a museum in the

1 Report of Board of Trustees, 1870-71, page 41.
2 University Catalogue and Circular of 1872-73, page 33.
3 University Catalogue and Circular of 1890-91, page 34.
4 A Pictorial Description, 1919, page 9.

5 University of Illinois Bulletin, Vol. XXXVIII, No. 10. 1940.
6 University Catalogue and Circular of 1890-91, page 34.

west wing of the same floor, that contained a large number of samples of merchant iron, a number of full-size joints of iron bridges, and a large number of models of bridges and elevated railroads. The drafting rooms were equipped with a type of double drawing desks that all other departments in the College, except Architecture used. The filing cases contained drawings of many actual engineering works then in service.

As the student enrollment grew and other departments moved into other buildings, civil engineering took over much of the space in Engineering Hall for its offices, recitation rooms and drafting rooms. For example, after the Department of Architecture moved out of Engineering Hall at the beginning of the second semester of 1927-28, most of the space vacated was taken over by the Department of Civil Engineering, and the Department readjusted its room assignments. Rooms 211, 214, and 309 were used as senior drawing rooms and Room 420 was used as a junior drawing room. Several of the other rooms on the fourth floor were taken as offices for instructors.

In 1945, the Department has at its disposal eight large drafting rooms for junior and senior students in design work. Each student is able thereby to have his own desk for work at any time much as he would in a commercial drafting office.

D. DEVELOPMENT OF CIVIL ENGINEERING LABORATORY FACILITIES

General - As a means of supplementing the classroom instruction, a number of laboratories have been developed during the past seventy-five years to provide practice in the use of instruments, to study and examine various types of materials of construction, and to investigate utility systems dedicated to public-health service. These facilities have served, also, to provide means for the conduct of many experiments in connection with graduate study and with the programs sponsored by the Engineering Experiment Station. Brief descriptions of some of these developments follow.

Early Surveying Apparatus - The University Circulars of 1869-70 and 1870-71 stated that the school was provided with apparatus for surveying and engineering embracing all the field instruments necessary for making Government land surveys,

farm surveys, and for conducting railroad and topographical surveying and leveling. Such equipment included the transit theodolite, a level from Newton & Company's, London, two leveling rods -- the ordinary and self-reading; a first-class Vernier compass; two brazed-link steel chains -- Gunther's and engineer's; instruments for stadia surveying, adopted in the Government surveys.

It had also a model truss bridge, twenty feet in length, with movable braces, and other apparatus for practical illustration.

The Catalogue of 1872-73 stated:[1]

"This School is provided with both English and American instruments for the different branches of Engineering Practice and for the Astronomical work of Higher Surveying. It has numerous models for illustration of its specialties and access to the Cabinets of the other Schools.

"Some expensive and accurate instruments are being added to the Cabinet, which are being made by the Instrument Maker of the U.S. Surveys. These are the first of a complete set of Geodetic and Astronomical Instruments which with a few stations, will make possible practical instruction in Geodesy.

"An Astronomical Observatory for meridian observation and of suitable size for the Practical Exercises in Astronomy, has been erected and is in use. An equatorial telescope has been mounted for the use of the students. A set of Smithsonian Meteorological instruments has been procured and placed in position for making observations".

The 1890-91 issue of the University Catalogue and Circular contained the following statement:

"The school is provided with the instruments necessary for the different branches of engineering field practice, including chains, tapes, compasses, plane tables, stadias, transits, levels, barometers, base rods and comparing apparatus, sextants, engineer's transits arranged for astronomical observation, and solar compass attachments for transit.

"A portable altitude and azimuth instrument of the latest and best form from the celebrated makers, Troughton & Simms, of London, is used for instruction in geodesy and practical astronomy. It is read by micrometer microscope to single seconds, both of altitude and of azimuth. The astronomical observatory is provided with an equatorial telescope, and astronomical transit, with attachment for zenith telescope work, a chronometer, and a set of meteorological instruments".

<u>Early Surveying Areas and Field Problems</u> - Even as early as 1872, the University had a specially-prepared area to facilitate the practice of topographic and land surveying in which the difficulties of plane surveying were presented to the beginner as soon as he was able to meet them, and where he was taught practical methods of overcoming them. This was subdivided by a large number of lines whose

1 Page 35.

positions were accurately known by the instructors, but not by the students. The students were thus required to determine the positions of the "corners" by various methods and to calculate the enclosed areas. The number of divisions was so large that no two students had the same problem and so accurately laid out that the correctness of the students' work could at once be determined.

Other problems were given in determining distances, passing obstacles, avoiding local attractions, etc., for which the ground was prepared. In these problems, too, all possible distances, directions, areas, and elevations were accurately known; hence the instructors knew beforehand the precise results which the students should obtain. Not a single problem or exercise was given in which there was wanting an absolute check upon the accuracy of the work. This was an incentive to the students and enabled the teacher to show them the degree of accuracy attained and also to point out the errors.

Surveying after 1894- When Engineering Hall was completed in 1894, the surveying equipment was kept in Room 105 on the first floor of that building. The instrument room contained a large number of wall lockers where the surveying instruments were kept. It also contained the tables used in the computation and the drawings pertaining to field work. The surveying equipment consisted of five engineer's transits, two solar transits, two mining transits, five compasses, five ordinary levels, two precision levels, three common and two fine planetables, stadia boards, level rods, flag poles, chains, tapes, and other necessary apparatus. Each instrument was placed in a separate locker and only the person using it had access to it. The work shop in Room 103 adjoining that room was equipped with tools and supplies for repairing the instruments.

In 1894, when astronomy was a required subject in Civil Engineering, the engineering observatory was located in a separate building. It had in it mounted on brick piers, an astronomical transit, an alt-azimuth instrument reading to seconds, two polar chronometers, one siderial chronometer, two sextants, and several barometers.[1]

---

1 The Technograph, 1894-95, Pages 177-78.

As the number of engineering buildings increased and the space available for surveying purposes dwindled on the north campus, it became necessary to go to the south campus to conduct the field exercises. Finally, the distances became so great and it took so much time to come and go that it seemed advisable to obtain quarters near the surveying fields for the surveying equipment. Accordingly, the old Horticultural Building was taken over in 1923, and adapted to surveying needs. The division of surveying, under the immediate direction of Professor W.H. Rayner, moved into it then and still occupies it in 1945. The building contains the instrument locker rooms and drafting rooms for the surveying courses and offices for some of the teaching staff giving instruction in surveying subjects.

Appropriate equipment of newest designs has been gradually accumulated for different grades of service. Numerous engineers' and solar transits, ordinary and precise levels, plane tables, sextants, rods, tapes, and smaller instruments were made available for regular plane-surveying practice. Several instruments of high precision were also made available for advanced work in hydrographic and geodetic surveying. In 1945, there is a sufficient number of instruments with all supplemental equipment for approximately 30 transit parties, 30 level parties, and 10 plane-table parties at the same time. The Department has, also, a representative assortment of calculating machines to enable the students to acquire some proficiency in the use of such devices and to make survey and other computations in connection with their classroom and laboratory assignments.

Many civil engineering students begin their engineering practice either before or after graduation in positions that involve some knowledge of surveying. This is one connection they can make with industry whereby their University experience enables them to render immediate service to employers without undergoing the usual period of apprenticeship so often required to attain professional status.

Summer Surveying Camp.- Camp Rabideau - After much of the space conveniently located for surveying practice on the University campus had been taken for building purposes, and after the student enrollment had increased to the point where

the available areas were no longer adequate, serious consideration was given to the subject of a summer camp that would provide facilities commensurate with the needs for instruction in surveying practice. As early as 1910, an effort was made to locate suitable grounds for a camp site in a number of places in both the upper and lower peninsulas of Michigan, but no particular section seemed to meet all of the requirements of an ideal site, a rough and rugged, unsettled country, dotted with lakes and traversed by water courses, where students would work under a variety of conditions somewhat simulating those generally found in actual practice. Later, various places in Illinois, especially the regions near Danville and in a number of State parks were considered, but none of these seemed entirely adequate. The search continued, however, and the matter was definitely decided in the latter part of 1945, when Camp Rabideau, a former CCC Camp located about six miles from Blackduck and about twenty-five miles northeast of Bemidji, in the million-acre tract of the Chippewa National Forest of Northwestern Minnesota was chosen as the most desirable spot having all the opportunites requisite for wide range of surveying experience. The tract was leased form the U. S. Forest Service, approval having been given by the University Board of Trustees on December 11. It is a note of interest to mention that the camps of the University of Minnesota and of Iowa State College are also located in this area.

The Camp, consisting of seventeen frame buildings lighted by electricity and well adapted to the University's use, provides dormitory facilities for about one-hundred and fifty persons with complementary mess hall, bath house with hot and cold showers and toilets, hospital, and recreation hall, in addition to the necessary classrooms, drafting rooms, and library accommodations. The Camp has an excellent deep-well water supply system and a very satisfactory sewage disposal plant. The adjoining lakes offer unusual opportunities for hydrographic surveying and the near-by streams corresponding facilities for stream gaging and measurement. In addition, the region offers exceptional opportunities for such recreational diversion as swimming, fishing, canoeing, and hiking.

The Camp, under the general direction of Professor W. C. Huntington and in

immediate charge of Professor W. H. Rayner, is in operation for an eight-weeks' period during the months of July and August, and all students registered with the Department of Civil Engineering are expected to attend between their freshman and sophomore years. The work, consisting of lectures, quizzes, and drawing-room exercises supplemented by appropriate field practice, covers the theory and practice of plane, topographic, and route surveying, and is equivalent to that formerly offered in the two three-hour courses of Plane and Topographic Surveying and one hour of Route Surveying, giving a total of seven hours of University credit for the period. For the eight-weeks' session, the University tuition fee is $20 for residents of Illinois and $40 for non-residents; board is provided in addition at cost. Each student pays his own transportation expenses to and from the Camp. The area is served by U. S. Highway 71 and the International Falls branch of the Northern Pacific Railway.

The Cement and Masonry Laboratory, 1868-1923- Laboratory work in cement and masonry began in 1889 in the store room off the boiler room on the ground floor of the University Hall. The University bought a few briquette molds and a pair of grips which the students utilized in a home-made cement-testing machine in conducting a series of tests on the adhesion of mortar to brick and on the strength of lime-cement mortar of various proportions.

In 1892, the Department established on the ground floor of the Chemistry Building (now Harker Hall) one of the first, if not the first, cement laboratory at an educational institution. The equipment was quite satisfactory, except that, for the number of students, the supply was too small. In conducting the experiments, the students, even at first, received definite printed instructions as to the methods of performing the work, and made formal written reports thereon.

Upon the completion of Engineering Hall in January, 1895, the cement and masonry laboratory was moved into Rooms 109 and 111 on the first floor of that building, and the equipment and the scope of the work were considerably increased. The equipment consisted of a cement testing machine, several briquette moulding machines, a number of slate tables, briquette moulds, scales, sieves, a rattler and a stone grinder, the last two being driven by an electric motor. The

laboratory was one of the best in the country.[1]

During the years 1904-06, the laboratory was again located in one of the rooms on the ground floor of the Old Chemistry Building -- at that time occupied by the Law School and called the Law Building, and now known as Harker Hall. In 1906, the laboratory moved into the north bay of the Mechanical Laboratory, and remained in that location for a number of years. It was provided with apparatus for making the usual tests of hydraulic cement and sand. Facilities were also provided for testing the ingredients of concrete and for mixing and testing concrete materials. The apparatus and the facilities installed in this laboratory continued to make it the best of its kind in the land. According to a circular issued in 1908-09, the laboratory contained all the materials and modern appliances necessary for the proper instruction of one hundred students in sections of twenty-five each. Each student had a desk and an individual locker for his apparatus.

In 1915, the laboratory was moved into the first or mezzanine floor of the quarters vacated by the Department of Ceramic Engineering in the old Ceramics Building, now the southwest corner of the Mechanical Engineering Laboratory, because the space it occupied in the north bay was sorely needed by the Department of Mechanical Engineering for laboratory practice. This cement and masonry laboratory remained in this new location until 1923, having been amply supplied with slate tables, testing machines, molding machines, sieves, and sample barrels of hydraulic cement, varieties of sand, and other necessary materials.

<u>The Cement and Concrete Laboratory, 1923-1945</u> - The materials of the cement and masonry laboratory, or the cement and concrete laboratory as it came to be called, were transferred to new laboratory quarters located in the old Boiler House immediately north of the Boneyard after that building was completely refitted in 1923-34. These new quarters were provided with bins for the storage of cement standard sand, and ordinary and coarse aggregates. Ample spade was available for the student cement tables and for the molding of concrete specimens. There was a separate moist room for storage of these finished specimens. There was, too, a briquette storage tank and a moist closet with an automatic temperature regulator.[2]

1 The Technograph, 1894-95, Page 177.
2 The Technograph, May, 1924, page 198

Some new equipment made available there included a Ro-tap shieve shaker, a 200,000-pound hydraulic compression testing machine, a motor-driven Jaeger mixer, and additional 2-inch by 4-inch and 6-inch by 12-inch cylindrical molds.

When the new Materials Testing Laboratory, now the Arthur Newell Talbot Laboratory, was completed in 1929, the cement and concrete laboratory was moved from the Old Boiler house into a large room on the ground floor of the northeast wing of that building where it has remained to date. Along the south side of the room are three moist rooms for the curing of concrete specimens. There are four large storage bins for materials located outside on the north side of the building with access through the north wall.

The equipment in this room includes twenty student work tables for individual use, various types of cement testing machines, balances, sieve shakers, material bins, recording thermometers, and concrete mixers. It also includes a steam bath, moist closet, gyratory riddle, drying oven, 200,000-pound hydraulic compression testing machine, field concrete-beam testing machine, flow table, refrigeration unit, and miscellaneous apparatus and equipment.

In a small sound-proof room adjoining this laboratory is installed the original Talbot-Jones rattler for testing the wearing qualities of concrete, and also a standard A.S.T.M. brick rattler.

This collection of equipment enables the students to apply all of the ordinary regulation and many special tests to cement and concrete according to specifications that have been standardized for such materials, and to gain some proficiency in the use of apparatus generally employed for such purposes. The arrangement of tables for individual work requires the students to carry on independently thereby compelling them to that extent to rely upon their own initiative and resourcefulness to bring the experiments to successful conclusion.

<u>The Road Materials Laboratory, 1906-1923</u> - The road materials laboratory was provided as a part of the Engineering Experiment Station in order to supply information to the State Highway Commission through tests of all kinds of road materials. More specifically, the purpose of the laboratory was to study the road

building materials of the State and to devise new methods of making tests that would represent more accurately the action which materials must undergo when actually in service on the highways. The equipment for testing stone, gravel, and brick was provided and was installed during January, 1906. The machines, ~~were~~ first set up on the ground floor of the Electrical Engineering Laboratory, ~~It~~ included a ball mill, a briquette molding machine, and an impact testing apparatus for determining the cementing properties of macadam stone. The laboratory was also supplied with a variety of rattlers and other appliances for testing paving brick and for determining the relative efficiencies of different joint fillers for brick pavements.

In September, 1906, the equipment was moved to the north bay of the Mechanical Engineering Laboratory and by the following December the road materials laboratory was fully equipped for making complete mechanical tests of road-building materials. It was supplied with scales and balances, Deval abrasion and Page impact machines, Dorrey hardness testing machine, stone crusher, ball mill, hydraulic press, core drill, polishing disc, sieves, a National Brick Manufacturers' Association standard brick rattler, and the Talbot-Jones brick rattler mentioned under a previous heading. The power was supplied by one 2-horsepower and one 10-horsepower induction motor. At that time, the laboratory[1] was one of the most outstanding of its kind in the United States.

In 1915, the laboratory was moved from the north bay of the Mechanical Engineering Laboratory to the room now occupied as a shop on the first floor of the old Ceramics Building, now a portion of the Mechanical Engineering Laboratory. Considerable equipment had been accumulated by 1915 for testing asphalts and bituminous materials, and this was set up on the second floor of this same building. By 1923-24, the work of the road materials laboratory had been sufficiently extended in the work of analysis of oils, tars, asphalts, and other similar materials that the descriptions thereafter were listed in the Annual Register under bituminous and non-bituminous laboratories. These are described further in

---

1 "The Road Materials Testing Laboratory of the University of Illinois", by L.G. Parker, The Technograph, 1906-07, pages 57-64.

the following paragraphs.

The Bituminous Laboratory, 1923-1945 - The room which formerly housed the cement laboratory on the first floor of the old Ceramics Building was completely equipped in 1923-24 for elementary bituminous work. Chemical facilities, gas, and electrical appliances were added for making all the standard analyses and many special tests of bituminous materials such as asphalts, tars, and other products used in road and building construction, and other engineering work.

The old bituminous laboratory on the second floor was then turned over to use in advanced work in this field for tests which demanded special apparatus and the use of a gas hood. The room was provided with a six-stall gas hood with sliding doors, transite partitions, bottom boards, and ventilating fan. Some of the additional equipment installed in the advanced laboratory and the elementary laboratory included a Rotarex extractor, a small electric oven, a Saybolt-Furol viscosimeter, and several types of extraction and distillation apparatus.[1] A centrifuge having a maximum speed of 3,600 r.p.m., was added in 1924-25 to be used in making tests of asphalts, oils, and other bituminous mixtures.

When the new Materials Testing Laboratory, now the Arthur Newell Talbot Laboratory, was completed in 1929, the apparatus used in the elementary bituminous laboratory was transferred from the Old Ceramics Building, now the southwest corner of the Mechanical Laboratory, to Room 201 on the third floor of the northeast wing of the new building. This room still used for this purpose, contains a large work table with a ventilated hood, twelve hooded booths ventilated by a fan, a filtration table with sixteen suction pumps, a centrifugal extraction machine for the examination of bituminous mixtures, a ductility machine, a rotary shelf oven, and several smaller ovens, a constant-temperature water bath, asphalt penetration machines, eight analytical balances, specific-gravity apparatus, Engler viscosimeters, etc. Small equipment is kept in 150 twelve-inch cubical lockers.

The advanced bituminous laboratory was at first located in Room 207 at the south end of the east wing of the third floor of this same building, and was

1 The Technograph, May 1924, Page 198.

equipped with six ventilated compartments, constant high-temperature oven, centrifuge, centrifugal extraction machine for the examination of bituminous materials, chemical desk, and miscellaneous small equipment. In 1936-37, much of the apparatus in this laboratory was transferred to the elementary bituminous laboratory to make room for a portion of the sub-grade soils laboratory, so that after that time, most of the bituminous work was done in the one room.

The use of this collection of apparatus serves to give the students a good idea of the behavior of bituminous materials under service conditions and to indicate some of the problems that they must face in the design, construction, and maintenance of roads and pavements constructed with bituminous products.

The Non-Bituminous Laboratory, 1923-1945 - The removal of the cement and concrete equipment from the Old Ceramics Building (now a part of the Mechanical Engineering Laboratory) to its new quarters provided in the Old Boiler House in 1923-24, left much-needed space for the expansion of the non-bituminous laboratory and added greatly to the convenience and efficiency of that laboratory.

When the new Materials Testing Laboratory, now the Arthur Newell Talbot Laboratory, was completed in 1929, the equipment was transferred from the non-bituminous Laboratory in the Old Ceramics Building mentioned above to the east wing of the third floor of that new laboratory -- part of it to Room 201, the elementary bituminous laboratory, and part to Rooms 205 and 206. This equipment together with what has since been accumulated, consists of two drill presses with diamond-set core drills for drilling one-inch and two-inch cores, a high-speed abrasive cut-off saw, a Weaver forcing press for preparing abrasive specimens, a ball mill, a briquette molding machine, a Page impact machine for cementation, a Page impact machine for toughness, a Deval abrasion machine, a Dorry machine for hardness, a Ro-tap sieve shaker, and a number of ovens, pan racks, balances, and miscellaneous small appliances.

As previously mentioned, the brick rattlers for testing the quality of paving brick are located in a small sound-proof room on the ground floor of the east wing. In this room is located, also, the original Talbot-Jones rattler used

for testing the wearing qualities of concrete.

This assemblage of equipment provided for the most part under the immediate supervision of Professor C.C.Wiley, for conducting regulation tests according to standard specifications of various engineering organizations and societies, is well adopted to the study and classification of such materials as brick, stone, gravel, sand, and other non-bituminous substances used in hard-road construction in connection with either instructional or experimental programs.

The Structural Research Laboratory - A portion of the old Boneyard Boiler House was remodelled to some extent in 1923 for use as a structural research laboratory for work in reinforced concrete carried on by Professor W. M. Wilson. Two new testing machines were installed there,--one a 300,000-pound Riehle machine purchased in 1923, capable of taking a 20-foot beam, column, or tensile specimen, and the other a 30,000-pound, 3-screw Riehle machine, acquired in 1924, equipped with autographic attachment.

When the new Materials Testing Laboratory, now the Arthur Newell Talbot Laboratory, was completed in 1929, the structural research program was materially expanded, for not only was the old apparatus transferred to the new location, but also much new equipment was added, occupying the west end of the south bay and the main portion of the north bay. The large fatigue machines located in the south bay, some of the largest of their type in existence, are designed to study the fatigue phenomena of large-size plates, electric welds, and riveted joints under repeated and reversed stresses. Operating continously in applying a load of 200,000 pounds at the rate of 185 times a minute, the equipment accelerates conditions as they usually occur in practice to accomplish in a comparatively short time what it would ordinarily take years to do under service conditions.

The laboratory in the main or north bay is shared with the Department of Theoretical and Applied Mechanics for the study of the behavior of large-size specimens of metal, wood, reinforced-concrete and other structures under the action of tensile, compressive, transverse, shearing, and torsional force. The room, 40 feet wide by 147 feet long, occupies the central portion of the building to its full height, and is served by a 10-ton traveling crane that operates 50 feet above the floor line. Of the several large testing machines located in this

room used mainly in the conduct of research, the largest is the Emery-Tatnall machine of 3,000,000 pounds capacity, which is capable of handling a 38-foot tension or compression member. Another is a 600,000-pound Riehle universal machine designed to receive a 25-foot tension or compression specimen. Still others include a 230,000-inch-pound Olsen torsion machine and a 200,000-pound Riehle universal machine. All of these machines are described more fully under Theoretical and Applied Mechanics. In addition, there was installed there, also, the 300,000-pound and the 30,000-pound Riehle machines described above.

The Soils and other Granular Materials Laboratory - In 1936-37, most of the advanced bituminous laboratory apparatus and stone-testing equipment was transferred to the elementary bituminous laboratory; and the rooms, 206 and 207, in the Talbot Laboratory thus vacated, were fitted up as a laboratory in soils mechanics. Room 208, which was devoted to soils has been continued for that use in the conduct of special research projects. After the sanitary engineering laboratory was moved from Room 113 in this building in 1943, the space thus vacated was also taken over for soil-mechanics research purposes.

The equipment, augmented from time to time, consists of appliances required to conduct routine and special tests for the classification of subgrade soils and to examine the physical characteristics of soils in foundations and embankments. It includes apparatus for the study of such topics as hydromechanics, freezing and thawing, consolidation and compaction, subsidence and displacement, and shearing and bearing of soils. The special devices include shear and compression machines, pressure cells, permeameters, presses and consolidating instruments, and humid and freezing rooms. There are a number of model deep bins varying in size up to four feet in diameter for the study of bearing of grain against the bottom and sides of storage bins.

The Sanitary Engineering Laboratory, 1926-1945 - When the Department of of Municipal and Sanitary Engineering was discontinued in 1926, the work in sanitary engineering was transferred to the Department of Civil Engineering. The experimental work in sewage treatment continued to be carried on as before

under the immediate direction of Professor H. S. Babbitt[1], in the small wooden structure located east of Goodwin Avenue on the north bank of the Boneyard about on line with Harvey Street, until 1943, when a new Sanitary Engineering Laboratory Building was erected.

When the Materials Testing Laboratory (The Arthur Newell Talbot Laboratory) was completed in 1929, a sanitary laboratory for student use was provided in a suite of rooms on the second floor of the east wing of that building. It was equipped for making the standard microscopic and chemical analyses of water, and for the study of sewage. After the new Sanitary Engineering Laboratory Building was erected in 1943, as mentioned above, the desks, chemicals, and other facilities were moved to this new location. A room on the ground floor was set aside for graduate and other research work, and one on the second floor, for undergraduate ~~and other research work, and one on the second floor,~~ for undergraduate classroom use. In addition, some new apparatus, including refrigeration equipment, steam baths, and other appliances, was supplied.

This new Sanitary Engineering Laboratory Building provides also, for a tank room that contains two 15-foot and two 22-foot tanks all 10 feet in diameter, that are intended for research work in sewage disposal. The two tall ones are for settling purposes and the other two for digesting sewage. They are constructed of wood so that changes may be made from time to time as occasion requires. Around the tanks are a number of 1 1/2-inch heating pipes that were salvaged from the old plant. Other equipment including pumps, filters, air and oxygen tanks, and auxilliary materials, was installed.

This new building arrangement and its equipment provide excellent facilities for training leading to positions of responsibility connected with the construction of sanitation plants or with the administration of such facilities employed in government service, for the work of the sanitary engineer has steadily grown more specialized throughout the years in response to the demands for greater safety, comfort, and convenience in public health-service installations. The Army made

1 See Municipal and Sanitary Engineering, Chapter XII.

special use of this plant immediately after its construction to secure training for its enlisted men assigned to sanitary-engineering services.

E. MUSEUM MATERIALS AND COLLECTIONS

Apparatus for the Lecture Room - The University Catalogue and Circular of 1890-91 stated : "The school has numerous models for illustrating its specialties including models of bridges, roofs, joints, and connections; a large collection of drawings, photographs, and photolithographs of bridges, roofs, and engineering structures, numerous railway maps, profiles, etc.; maps of government surveys, and of plans and specifications. It has access to a complete set of lithographs of the lectures and drawings used in the government polytechnic school of France. The industrial museum (Museum of Engineering and Architecture) contains a large collection of building materials, of wood, brick, stone, and iron. The testing machine has a capacity of one-hundred thousand pounds for tension, compression, or bending; also a cement testing machine.

"The library is well supplied with the best and latest periodicals and books upon engineering subjects, to which the student has full access".

The Annual Register of 1910-11 carried the following statement: "The department is also provided with a collection of structural shapes, including full-sized joints of an actual railroad bridge, sections of columns, eye-bars, etc., and with lithographs, photographs, and blue-prints of bridges and buildings".

Photographic Enlargements - About 1930, a start was made to bring together for illustrative purposes, photographic enlargements of outstanding works in the field of civil engineering. This effort, continued to the present time, has resulted in accumulating a very comprehensive and instructive collection, representing buildings, bridges, water-power developments, highway layouts, and other construction projects. These enlargements assembled in the corridors of Engineering Hall, are valuable for classroom as well as other instructional purposes.

Model of Continuous Arch - A model of the three-span reinforced-concrete arch used in tests made by Professor W. M. Wilson for the Engineering Experiment Station series of outstanding tests described in Chapter XXV of this publication,

was displayed at the Century of Progress Exposition Exhibit at Chicago in 1933. After the Exposition closed, the model was returned to the University and placed in the corridor of the main floor of Engineering Hall as an exhibit for the benefit of students and visitors on the University campus. The model, excellently reproduced, presents an unusually attractive appearance,-the workmanship indicating the high level of thought, care, skill, and accuracy that were embodied in the design and construction of the original structure and in the conduct of the long series of systematic tests.

F. MISCELLANEOUS

Departmental Meetings - Throughout the school year, the Civil Engineering Staff holds dinner meetings once a month in the University Club. At these meetings the various members of the Department staff describe some phase of work under way or discuss some new problems in engineering or any matters of departmental interest that require attention. Members of other departments whose interest is in civil engineering, are invited to these meetings. Sometimes outside speakers are asked to address the sessions.

State Board of Structural Engineers - The Act of July 5, 1915, to provide for licensing of structural engineers, required that one of the members of the State Board should be a professor of civil engineering at the University of Illinois. The Board was discontinued on July 1, 1917, but its duties were taken over by the Department of Registration and Education with five persons, one of whom must be a professor of civil engineering at the University, to examine structural engineers. This position, when first created, was offered to Dr. Ira O. Baker, for many years Head of the Department of Civil Engineering here, but he declined it, and it was then offered to Dr. F. H. Newell, at that time Head of the Department. After Doctor Newell resigned in 1920, W. M. Wilson, Professor of Structural Engineering here, was appointed, and has held the position to date. The Board meetings are generally held in Chicago, because most of the practicing engineers seeking licenses are located there.

Special State Assignment on Concrete Pavement Joints - In May 1937, Governor

Horner asked that a committee of faculty men here be appointed to study the question of expansion joints in concrete pavements and report to him. This project involved an investigation of various types of joints then in service and a series of laboratory tests. The committee appointed by President Willard consisted of the following members:

J. S. Crandell
F. E. Richart
C. E. Wiley
W. C. Huntington, Chairman

The sum of $4,000 was provded by the Governor for the use of the committee.

The Committee served as a kind of referee in a controversy that had arisen between certain manufacturers of joints and the Illinois Division of Highways, because the testing engineer of the Division of Highways had refused to approve certain types of joints, while he did approve others. The joints under question were of the copper-seal type; and the investigations of the Committee showed that all joints of this type which had been in pavements as long as four years showed very extensive failures. The Committee recommended that no more joints of this type be used in the highways until they could show by service in the highway for a period of five years that they could give promise of lasting as long as the pavement. In the meantime, the Committee recommended that joints of the premoulded or poured type be used. These have their advantages, for they are able to accomplish as much as the copper-seal joint and are much cheaper.

Since the State of Illinois was spending over a million dollars a year on the copper-seal joints, the financial aspect of the investigation was very important because companies which had been furnishing the joints suffered a very serious blow. The evidence which the Committee secured was so convincing, however, that there were few objections from the manufacturers of the copper-seal joints.

The Committee presented its report in December 1937, and the Governor adopted it without change.

Kaskaskia Valley Report - A publication entitled "A Report on Certain Physical, Economic, and Social Aspects of the Valley of the Kaskaskia River" was prepared during 1937-38 by members of the staff of the University, the State

Surveys, and certain other State departments, at the request of the Illinois Planning Commission under the general direction of Professor W. C. Huntington, Head of the Department of Civil Engineering. The work of Professor Pickles of that Department was particularly outstanding in his summary of hydrology studies. The report, consisting of over 300 pages of mimeographed materials, was distributed during 1937-38 and was very well received. It was put to a number of uses, the most important of which were: to provide information on various phases of the Kaskaskia Valley itself; to serve as a guide for other reports being prepared in many parts of the community; and to serve as source materials in courses in social science, political science, and other collegiate subjects given at the University.

G. FACULTY PERSONNEL

General - A complete list of faculty members who have been connected with the Department of Civil Engineering in any capacity with the rank of instructor, research assistant, or higher, together with brief biographical sketches indicating promotions, titles, dates of connection with the University, and other items of interest compiled from official sources, is presented by rank in chronological order in the following pages.

a. Heads of the Department

General - Colonel Samuel Walker Shattuck was the first to direct the work of the Department of Civil Engineering and served in that connection from 1869 to 1871. Stillman Williams Robinson, Head of Mechanical Engineering, served also in charge of the Department of Civil Engineering during a portion of 1871. John Burkitt Webb was Head from 1871 until 1878. Ira Osborne Baker then became Head and remained in charge until 1915. Frederick Haines Newell succeeded him and held the position until 1920. Following his resignation, Professor Baker took over the work again and continued as Head until 1922, when he was relieved by Clement Clarence Williams, who guided the affairs of the Department until 1927. Whitney Clark Huntington succeeded him and has continued as Head to the present time. Biographical sketches of these men follow.

Samuel Walker Shattuck was born in Groton, Massachusetts, on February 18, 1841. In 1860, he was graduated with the degree of B.S. from Norwich University, then located at Norwich, Vermont. He received the A.M. degree there in 1868 and the C.E. degree in 1871. Immediately after graduation, young Shattuck volunteered in the Sixth Massachusetts regiment that became famous in Civil War Engagements. After the War, Colonel Shattuck returned to Norwich to teach mathematics and military tactics. In 1868, however, he came to the University of Illinois to become Assistant Professor of Mathematics and Instructor in Military Tactics. In March, 1870, he became Professor of Civil Engineering and Instructor in Mathematics here, but continued to teach all of the classes in Mathematics. It was evidently soon discovered, however, that the teaching of mathematics was sufficient to occupy all of his time, for in March 1871, he was made Professor of Mathematics, and Professor Robinson was given charge of the Department of Civil Engineering. While Professor Shattuck was serving as Head of the Department of Mathematics, he was Acting Regent for six months in 1873, Vice-Regent during 1889-1894, and Business Agent and Manager during 1873-1905. During 1905-1912, he was Professor of Mathematics and Comptroller. His honest and efficient methods in administering the University's financial affairs had a wholesome influence in promoting the steady growth of this institution. Professor Shattuck was given the honorary degree of LL.D. by the University during the Commencement exercises on June 12, 1912. He was retired on September 1, 1912, under an allowance from the Carnegie Foundation for the Advancement of Teaching, and on October 16, following, the University Senate in a special University convocation presented him with a gold medal as a mark of appreciation for the outstanding services he had rendered the University and the community. He continued to live in Urbana until his death on February 13, 1915.

John Burkitt Webb was born in Philadelphia on November 22, 1841. He received the C.E. degree from the University of Michigan in 1871, and was serving as Assistant Professor of Civil Engineering at that institution at the time of his appointment to the faculty of the University of Illinois. He joined the staff here in November, 1871, as Professor of Civil Engineering and Head of the

Department. Professor Webb was a man of maturity when he entered the University of Michigan, and was there distinguished for his high scholarship. He was an unusually expert draftsman, a fine mathematician and a very skillful workman in both wood and metal, for he had acquired valuable experience in machine-shop practice during his pre-college days.

In his dealings with students, Professor Webb was a severe task master, and was satisfied with only perfect work even to the minutest detail. He abhorred slovenly work; and a misplaced letter in a written word was to him a gross, almost unpardonable, blunder. In mathematics his vision was so clear and his analysis so keen, that he saw at once the solution of abstruse problems that seemed impossible to his most brilliant students, and he could detect instantly the student's error. He was rather severe in manner, and somewhat gruff in his criticisms of the work of his students. The students as a rule were but illy prepared, and his exactions in language, analysis, and demonstration were in a measure, if not entirely, beyond the student's ability; and because of the lack of a mutual understanding and sympathy, not infrequently alienated the student.

His teaching of descriptive geometry and analytical mechanics was superb, and aroused the intense enthusiasm of the best students. He insisted upon a thorough analysis and complete demonstration, and would not permit the student any self-deception. In his teaching of drawing, he insisted that the student should perform every operation with the utmost exactness and repeat it until he had acquired a high degree of expertness, which irritated the less patient and less earnest students. However, in later years many of his students freely admitted that they received more value and benefit from his instruction than they at the time believed.

In the early days of the Illinois Industrial University, it was generally believed that the institution was founded to establish new educational methods and to secure hitherto unattained educational results; and hence among the students, particularly those in engineering, there were not a few who looked upon any one who cultivated a new field or employed new methods, as a Moses leading the world out of slavery and darkness into the promised land flowing with

educational milk and honey. At that time the content and arrangement of college courses in civil engineering were already reasonably well established, and hence Professor Webb was not set to cultivate a virgin field as were his colleagues -- Professors Robinson and Ricker. Apparently, Professor Webb was discredited in the minds of the students in comparison with Professor Robinson and Professor Ricker because he was not an innovator.

Professor Webb believed more strongly in the educational than in the vocational value of a college course. He put more emphasis on drawing, language, and mathematics than upon the so-called practical subjects; while many, perhaps a great majority, of the students of that day came to the University for what they called a practical education, and seemed interested only in the acquisition of facts, formulas, and methods which they thought would be immediately applicable in practice after they left college halls. The difference between these two points of view, or rather the lack of an understanding of the relations of these two theories of technical education, caused friction and dissatisfaction between the professor and some of his students; but those who kindly and faithfully accepted his instruction acknowledged themselves greatly benefited thereby.

In June, 1878, Professor Webb obtained a leave of absence to go abroad, but without returning to the University, resigned the following year. After spending two years in European study, he became Professor of Applied Mathematics at Cornell University; and after holding that position until 1885, went to Stevens Institute of Technology as Professor of Mathematics and Mechanics -- a position he held until 1907, when he retired on a Carnegie pension. He died on February 17, 1912, in New York City.

<u>Ira Osborn Baker</u> was born in Linton, Indiana, on September 23, 1853, and was graduated from the Mattoon, Illinois, High School in 1870. He taught a country school in Indiana for six months, and then entered the University of Illinois in March, 1871, with nearly two years' advance standing. During his college course, he taught school in Indiana again --this time for one year -- and was graduated from the civil-engineering curriculum at Illinois in June, 1874. He was Assistant

in Civil Engineering and Physics here from September, 1874, to June, 1878, receiving the C.E. degree in 1877. For the year 1878-79, he was in temporary charge of the Department of Civil Engineering. In June 1879, he was made Assistant Professor in charge, and in June 1880, Professor of Civil Engineering.

The young professor, like many others then in the university, had often to undertake a great variety of work; and in his earlier years of service was required at one time or another to teach the following subjects: General engineering drawing, surveying, railroad engineering, bridges, masonry construction, geodesy, descriptive and also practical astronomy, tunneling, contracts and specifications, roads and pavements, and analytical mechanics. His teaching of descriptive astronomy for several years and of physics for a comparatively brief period created delight and enthusiasm among general as well as the engineering students.

In 1889, Professor Baker undertook to improvise and bring together equipment for the start of a cement-testing laboratory, which he set up in a small space on the ground floor of University Hall. Gradually this project was expanded and given larger quarters, first in a room in the old Chemistry Building, now Harker Hall, and still later in one or another of the buildings of the engineering group. In a similar manner he set out to develop a road-materials laboratory; and in due time he had assembled an assortment of apparatus that, like the cement-testing laboratory, was highly successful in serving for both instructional and experimental purposes. These two pioneer laboratories, for no doubt they were the first of their kind in this country, were typical of the nature of the advances made in laboratory practice in the early days of the University, and served as models for many other colleges and universities in building up this phase of their educational plant. Professor Baker himself made extensive use of the facilities he had provided, to carry on investigations in brick, stone, cement, and concrete, and thereby made many notable contributions to our knowledge of the properties of these materials.

Not only was great diversity of interest and adaptability required of the teacher of the early days, but also it was often necessary for him to prepare

textbooks for his classes. In this connection, Professor Baker issued in blueprint edition a number of textbooks written by him for his classes. The author wrote out the many pages of these works long-hand on tracing paper, issuing them in blueprint form at a time when the process of blueprinting was a novel one. Among the subjects treated in this fashion were geodesy, bridges, masonry, economic location of railroads, and the use of surveying instruments. These first accomplishments as an author in a somewhat limited way led to his development of certain of the subjects into the standard treatises that have long been familar to engineers.

The first of these blueprint books issued in printed form was "Leveling -- Spirit, Barometric, and Trigonometric" in 1886, which in 1912 was republished in French. The next blueprint book to be issued in printed form was "The Use of Engineer's Surveying Instruments" in 1888. In 1892 a greatly enlarged edition of this book was issued. But the book which attracted the attention of the whole engineering world and made a national reputation for the author was his "Treatise on Masonry Construction", which was first published in 1889. It was the first comprehensive text on foundation methods and principles involved in the use of cement and concrete published in the English language. The reception of the book was instantaneous. It was highly praised by the technical press at home and abroad, and was introduced into the principal engineering schools in this country. It was used, also, in the technical schools of Japan, China, Mexico, and other countries. The book went through several editions, and was long a standard treatise. In 1891, Professor Baker published a pamphlet entitled "Durability of Brick Pavements", which was the first record of tests of paving brick and unquestionably did much to introduce brick as a paving material. Another of his books, "A Treatise on Roads and Pavements", published in 1903, was like his "Masonry Construction", a pioneer and was universally recognized and widely adopted as a textbook in its field. This work also went through several editions and was used wherever modern roads and pavements were built.

In addition to his textbooks, Professor Baker found time to write many articles that were published in engineering and educational journals and in the

proceedings of engineering societies. He was author of one bulletin and one circular of the Engineering Experiment Station here.

Doctor Baker was an excellent teacher and a wise student counseller, as the thousands of his students almost the world over gratefully testify. He gave unstintingly of his time to the affairs of student organizations, especially of the Civil Engineers' Club, which later became the Student Section of the American Society of Civil Engineers. Probably the most notable characteristic of his teaching practice, was his enduring persistence on the use of good English in both the written and spoken word. He chose his own phrases with meticulous care and expected his students to exercise similar diligence in expressing their way of life.

The work of Professor Baker was not all done at the University, for he carried the name of the University into the engineering societies and to engineers and business men engaged in professional and administrative practice. He became a member of the Western Society of Engineers in 1886, and was twice elected to office. One of the societies in whose membership Professor Baker took special pride was the Illinois Society of Engineers, an organization which was conceived and founded by him in 1886, and which has had a very active and useful part in the development of engineering policies and principles throughout the State. Professor Baker became a member of the American Society of Civil Engineers in 1893, and was twice elected to membership on its nominating committee.

Another society is indebted to Professor Baker for its formation. When the Engineering Congress of the World's Columbian Exposition was first considered, Professor Baker suggested and urged by forcible argument that a division of engineering education be included in it. He was made chairman of the committee which had charge of the division, and was instrumental in securing papers and speakers for a very promising program. He organized the convention and presided at the meetings of the division, which was designated as the Engineering Education Section. The proceedings of these meetings were printed as Vol.I of the Proceedings of the Society for the Promotion of Engineering Education, and Professor Baker is properly called the founder of this influential society. He had a

considerable part in its further development, serving as its president again in 1899-1900.

For three of four years he was one of a Board that devoted a great deal of time to the preparation of a building law for the State of Illinois; but unfortunately the law did not pass the legislature, largely because of the antagonism of building interests in Chicago that would have been required to build more safely.

For many years Professor Baker rendered valuable services in advising various public officials concerning drainage matters and particularly concerning highway bridges. That he saved Illinois counties many thousands of dollars was the formal written appreciation of the expert services of Professor Baker by one such board of county supervisors.

For his period of long and faithful service, Professor Baker was granted the honorary degree of D.Eng. by the University in 1903. In commemoration of his forty years of continuous teaching and administrative activity as a member of the faculty of the University, he was further honored by a banquet given in Chicago by Alumni on March 17, 1914. He continued as Head of the Department of Civil Engineering until May 1, 1915, when he was relieved of his executive responsibilities by Frederick Haines Newell, although he continued to carry a full teaching schedule. When Professor Newell resigned in 1920, Professor Baker again became Head of the Department and continued in that capacity for two years -- until he was relieved by Clement Clarence Williams in 1922.

In all, Professor Baker taught in the University for forty-eight years, during thirty-nine of which he was in charge of his department. Under his direction, it became one of the leading departments of civil engineering in this country and trained a large proportion of the most distinguished graduates of the College of Engineering.

Professor Baker was, through all of his many years of service, loyal to the interests of his alma mater, declining more than once, offers which were tempting from more than one point of view; and the University of Illinois owes him a debt of gratitude for the allegiance which he, as an alumnus, gave.

Having reached the University age limit in 1922, Professor Baker retired with the title Professor of Civil Engineering, Emeritus. "In retiring after forty-eight years of loyal and constant service to the University, to the State, and to the engineering profession at large, Doctor Baker laid down his work with the comforting satisfaction that he had done a great job well. He left behind him a monument to his enthusiasm, industry, and skill, not only in the strong school he had helped to build and the books he had written, but in the host of accomplished engineers who had lighted their brands from the torch he carried". Professor Baker continued to reside in Urbana until his death on November 8, 1925.

Frederick Haynes Newell, who on May 1, 1915, succeeded Ira O. Baker, recently resigned as Head of the Department of Civil Engineering after spending thirty-six years of service in that capacity, was born at Bradford, Pennsylvania, in 1862. He was graduated from the curriculum in mining engineering at Massachusetts Institute of Technology in 1885. Mr. Newell was Assistant Hydraulic Engineer, U.S. Geological Survey, during 1888-90, and was Hydrographer for the Survey during 1890-1902. To him was due the conception of the U.S. Reclamation Service of which he was Chief Engineer from 1902 to 1907, and Director from 1907 to 1915. These positions earned for him a national reputation among engineers and men in public life. Under his direction, immense areas of arid land were redeemed by irrigation through the construction of a number of gigantic dams and many miles of conduits and irrigation ditches. He was granted the honorary degree of D.Eng. by Case School of Applied Science in 1912.

Doctor Newell was author of numerous government reports and of several text-books. Among the books are "Irrigation in the United States", "Irrigation Management", and "Water Resources, Present and Future Uses". He was joint author with Daniel W. Murphy of a text entitled "Principles of Irrigation Engineering" and with Clarence E. Drayer of another entitled "Engineering as a Career". He was editor of a book "Planning and Building the City of Washington", published by the Washington Society of Engineers. In addition, Professor Newell contributed numerous articles to engineering journals and society proceedings.

Before coming to the University, Doctor Newell had had no pedagogical

experience; but he had an inquiring and open mind, and promptly and enthusiastically proceeded to study the educational process from the general standpoint rather than from the attitude, equipment, and objective of the student. Doctor Newell was a pleasing public speaker, and gave many interesting lectures on reclamation work, and usually illustrated them by numerous beautiful pictures. Toward the end of his services, Professor Newell frankly said that he could not get interested in the educative process; and in October, 1920, he resigned, and returned to Washington, D.C., to engage in consulting engineering practice. He continued to live there until his death on July 5, 1932.

Clement Clarence Williams was born at Bryant, Illinois, on February 21,1882. He received the B.S.degree at Illinois in 1907 and the C.E. degree from the University of Colorado in 1909. He was successively Instructor, Assistant Professor, and Acting Professor of Civil Engineering at the University of Colorado from 1907 until 1914. He was then Professor of Railway Engineering at the University of Kansas from 1914 to 1918 and Professor of Civil Engineering and Head of the Department there from 1918 to 1922. He came to the University of Illinois on September 1, 1922, as Professor of Civil Engineering and Head of the Department and remained here until 1927, when he left to become Dean of the College of Applied Science at the University of Iowa. He resigned that position in 1935 to become President of Lehigh University. He remained at Lehigh until the fall of 1944, when he resigned to establish a general practice as consultant in engineering and industrial education at Madison, Wisconsin.

He is the author of three textbooks in engineering, entitled "Design of Railway Location", "Design of Masonry Structures and Foundations", and "Building an Engineering Career". He is a member of numerous engineering and other societies, having served as President of the Society for the Promotion of Engineering Education during 1934-35 and as President of the Pennsylvania Society of College Presidents during 1940-41.

President Williams was the recipient of many honorary degrees during his term of office at Lehigh. He was granted the degree of LL.D. by Lafayette College in 1935, of Eng.D. by Northwestern University in 1936, and by Bucknell

University in 1937, Sc.D. by Hannemann Medical College in 1938 and by Muhlenberg College in 1940, and LL.D. by Rutgers University and also by Moravian College in 1941.

Whitney Clark Huntington was born in Denver, Colorado, on September 29,1887. He received the B.S. degree from the University of Colorado in 1910, the C.E. degree there in 1912, and the M.S. degree in 1913. He was Instructor in Civil Engineering and Mechanics at his alma mater during 1910-14, Assistant Professor, 1914-18, and Professor and Acting Head of the Department, 1919-26. In addition to his other duties there, Professor Huntington served as Head of the Construction Department in charge of preliminary planning, structural design, and construction of several buildings on the campus during the period from 1917 to 1926.

In 1926, Professor Huntington came to the University of Illinois as Professor of Civil Engineering and Head of the Department, and has remained here to date. He is an excellent administrator and teacher, admired and respected by all those with whom he has been associated in University and professional circles. In 1933, he was made Chairman of the Engineering Advisory Board of the Civil Works Administration for Illinois. He served also as Vice-chairman of the State Advisory Committee of the Work and Rehabilitation Division of the Illinois Emergency Relief Commission during 1934-35. In 1935, he was Chairman of the Illinois Organization Committee of the American Engineering Council. He has served also on many important University committees, having been Chairman of the University Building Committee since 1937.

Professor Huntington is author of a book entitled "Building Construction", that is widely used as a reference and text by practitioners and schools in this country. He had the honor of being awarded the Alumni Norlin Medal for distinguished achievement, by the University of Colorado at its Commencement exercises in 1937. This medal -- the highest honor the University of Colorado Alumni Association can confer -- is awarded annually to that alumnus of the University of Colorado that has attained outstanding eminence in his chosen profession.

b. Other Professors

Charles Alton Ellis (A.B., 1900, Wesleyan University; C.E., 1922, University of Illinois) was engaged in engineering practice after graduation until he joined the staff of the University of Michigan, where he remained as Assistant Professor of Civil Engineering during 1908-1912. After two years in practice again, Professor Ellis came to the University of Illinois in September, 1914. During 1914 and 1915, he was Assistant Professor of Civil Engineering, and during 1915-21, he served as Professor of Structural Engineering in charge of the courses in structures. In July, 1921, Professor Ellis resigned to accept a position as Vice-President of the Strauss Engineering Corporation, Chicago. Since 1934, he has been Professor of Structural Engineering at Purdue University.

Everett Edgar King (B.S., 1901, C.E. 1909, and M.S., 1910, Rose Polytechnic Institute; A.B. 1910, Indiana University; M.C.E., 1911, Cornell University) was engaged in railway practice from 1901 to 1907, when he became Professor of Civil Engineering at Oklahoma Agricultural and Mechanical College. He remained in that position until 1910, at which time he accepted a Fellowship at Cornell University. From 1911 to 1918, Mr. King was Professor of Railway Engineering at Iowa State and in 1918, he was made Professor of Railway Civil Engineering in the Department of Railway Engineering at the University of Illinois. When the Department was discontinued in 1940, Professor King was transferred to the Department of Civil Engineering, where he remained until 1945 when he was retired with the title of Professor of Railway Civil Engineering, Emeritus. He is author of a textbook entitled "Railway Signaling", and of one bulletin of the Engineering Experiment Station.

Wilbur M. Wilson (B.M.E., 1900, and C.E., 1914, Iowa State College; M.M.E., 1904, Cornell University) served during 1903-08 successively as Assistant Professor and Associate Professor of Mechanical Engineering at Iowa State College. Then after two years in structural-engineering practice, he came to the University of Illinois as Assistant Professor of Structural Engineering. He was made Associate Professor in 1919 and Research Professor of Structural Engineering in 1921, which latter title he has held to date.

Professor Wilson is author of nine bulletins and three circulars and

co-author of twenty-one bulletins issued by the Engineering Experiment Station. He wrote a section of 160 pages on "Statically Indeterminate Stresses" in a text-book edited by Hool and Kinne entitled "Stresses in Framed Structures".

The Western Society of Engineers awarded Professor Wilson with two Octave Chanute medals. The first award was in 1914 for a paper entitled "The Analysis of Wind Stresses in the Frames of Office Buildings", and the second one was in 1936-37 for a paper entitled "The Present Status of Structural Welding". Professor Wilson was awarded the J.James Croes medal of the American Society of Civil Engineers in 1936 for a paper entitled "Laboratory Tests of Multiple-Span Reinforced-Concrete Arch Bridges", and the Leonard C.Wason medal by the American Concrete Institute in 1938 for a paper entitled "Tests of Rigid-Frame Bridges". He was granted the honorary degree of Dr.Eng. by Iowa State College in 1942, and was elected a Director of the American Society of Civil Engineers for the period 1944-47. This is an extraordinary record of achievement and indicates the high esteem with which his work is regarded by his colleagues in the engineering profession.

Hardy Cross (B.A., 1902, and B.S., 1903, Hampden-Sidney College; B.S,,1908, Massachusetts Institute of Technology; and M.C.E., 1911, Harvard University) was engaged in engineering practice during 1908-10 and taught structural engineering at Brown University for the seven years between 1911 and 1918. He took up engineering practice again and continued in it until 1921, when he came to the University of Illinois as Professor of Structural Engineering in charge of the courses in that division. He remained here until 1937, when he became Professor of Civil Engineering at Yale University -- an appointment he has held to date.

Professor Cross is co-author with N.D. Morgan of a textbook entitled "Continuous Frames of Reinforced Concrete", and is author of three bulletins of the Engineering Experiment Station here. He was awarded the Norman medal of the American Society of Civil Engineers in 1934 for his paper on the "Analysis of Continuous Frames by Distributing Fixed-End Moments". He was awarded the Leonard C. Wason medal in 1936 by the American Concrete Institute.

Hampden-Sidney College conferred upon Professor Cross the honorary degree of Sc.D. in 1934, Lehigh University, the honorary degree of D.Eng. in 1937, and Yale, the honorary degree of A.M. in 1937.

Professor Cross was an outstanding teacher as well as scholar, and he had the happy but somewhat unusual faculty of arousing the intellectual curiosity of his students and of inspiring them to undertake the more difficult things of life with confidence of success.

Harold Eaton Babbitt (S.B., 1911, Massachusetts Institute of Technology; M.S. 1917, University of Illinois) was employed in engineering practice during 1911-13 and served as Assistant Engineer of the Ohio State Board of Health in 1913. He joined the University of Illinois in 1913 as Instructor in Municipal and Sanitary Engineering. He became Associate in 1918, Assistant Professor in 1919, Associate Professor in 1922, and Professor of Sanitary Engineering in 1925.

When the Department of Municipal and Sanitary Engineering was discontinued in 1926, Professor Babbitt was transferred to the Department of Civil Engineering and has remained in it to date.

Professor Babbitt is the author of the textbooks "Sewerage and Sewage Treatment", "Plumbing", "Water Supply and Purification", and of Section X of the Civil Engineers' Handbook. He is co-author with J.J. Doland of "Water Supply Engineering", and is the author of three bulletins and co-author of four more on sewage and sewage disposal issued by the Engineering Experiment Station that have been widely read and have been considered as valuable contributions to the fund of literature in the field of sanitary engineering.

John Stanley Crandell (B.S., 1904, and C.E., 1906, New York University) was employed in engineering practice during 1904-11 and served as Assistant Professor of Civil Engineering at Pennsylvania State College during 1911-15. For the next eleven years he was associated with the Barrett Company, and then he joined the faculty of the University of Illinois in September, 1926, as Professor of Highway Engineering to fill a newly-created position of that title.

Professor Crandell is author of the section "Highway Engineering" in the American Civil Engineers' Handbook.

James Joseph Doland (B.S., 1914, and C.E., 1927, University of Colorado; M.S., 1932, University of Illinois) spent several years after graduation in engineering practice including work with the Federal Bureau of Reclamation, then he came to the University in September, 1926, as Assistant Professor of Civil Engineering. He became Associate Professor in 1930 and Professor of Civil Engineering in 1934. He is co-author with H.E.Babbitt of a textbook entitled "Water Supply Engineering", and is author of the Water-Supply Section of the General Engineering Handbook. Professor Doland was given a leave of absence from his departmental duties during the year 1944 to supervise the construction of the University airport. In June 1944, he was granted the honorary degree of D.Sc. by St. Johns College, Collegeville, Minnesota.

George Wellington Pickels (B.C.E., 1904, University of Kentucky; C.E., 1911, University of Illinois) was engaged in engineering practice during 1904-07, then came to the University of Illinois as Instructor in Civil Engineering. He became Associate in Drainage Engineering in 1917, Assistant Professor of Civil Engineering in 1919, Associate Professor of Drainage Engineering in 1925, and Professor of Civil Engineering in 1931, and remained with the University until his death on December 2, 1944. Professor Pickels was author of a textbook entitled "Drainage and Flood-Control Engineering" and was co-author with C.C.Wiley of two textbooks, "Railroad Surveying" and "Route Surveying". He was author of two bulletins on drainage engineering published by the Engineering Experiment Station.

Thomas Clark Shedd (Sc.B. in M.E., 1913, Brown University; C.E., 1925, and M.S., 1933, University of Illinois) was Assistant and Instructor in Brown University during 1913-15 and Instructor in Civil Engineering at Lehigh University during 1917-18. He was engaged in engineering practice during 1915-17 and 1918-22. ~~through 1922~~. He joined the University in September, 1922, as Associate in Civil Engineering, and became Assistant Professor in 1925, Associate Professor in 1930, and Professor of Structural Engineering in 1934. He is the author of a textbook entitled "Structural Design in Steel" and co-author with J.Vawter of another one entitled "Theory of Simple Structures".

Carroll Carson Wiley (B.S., 1904, and C.E., 1910, University of Illinois) after two years of engineering practice came to the University in September, 1906, as Instructor in Civil Engineering. He was made Associate in 1914, Assistant Professor of Highway Engineering in 1919, Associate Professor in 1930, and Professor of Civil Engineering in 1937.

Professor Wiley is co-author with G. W. Pickles of two textbooks --"Railroad Surveying" and "Route Surveying". He is author of a textbook entitled "Principles of Highway Engineering". He is also author of one bulletin and one circular published by the Engineering Experiment Station. No doubt, Professor Wiley's most outstanding contributions to the success of the University's activities have been in connection with the Highway Short Courses and Conferences which he has directed since their beginning in 1914. As a result of his efforts in that direction, the prestige of his department and of the College has been materially advanced in the minds of those engaged in the highway-engineering profession.

Jamison Vawter (B.S., 1916, and C.E., 1923, University of Kansas; M.S., 1934, University of Illinois) was engaged in engineering practice during 1916-20, then became Assistant Professor of Mechanics at the University of Kansas. Professor Vawter joined the staff at the University of Illinois in September, 1922, as Assistant Professor of Civil Engineering. He became Associate Professor in 1931 and Professor of Civil Engineering in 1937.

Professor Vawter is co-author with T.C.Shedd of a textbook entitled "Theory of Simple Structures".

Nathan Mortimore Newmark (B.S., 1930, Rutgers University; M.S., 1932, and Ph.D., 1934, University of Illinois) was Research Assistant at Illinois during 1932-36, Research Associate during 1936-37, Research Assistant Professor during 1937-43, and became Research Professor in 1943. He made an outstanding scholastic record while carrying on his graduate-student work here. He is author of two bulletins, one circular, and one reprint and is co-author of four bulletins issued by the Engineering Experiment Station. Some of these publications have presented the results of experimental and some of analytical determinations, but all of

them are unusually interesting and are outstanding in their treatment and penetration of discussion and analysis of problems relating to structural design. For a paper entitled "Numerical Procedure for Computing Deflections, Moments, and Buckling Loads", Professor Newmark was awarded in 1945, the J. James R. Croes medal of the American Society of Civil Engineers.

Robert Aaron Hechtman (B.S., 1938, and M.S., 1939, University of Washington) was employed for a time after graduation, in research work at Lehigh University. He was then engaged in industrial practice until he joined the staff here in January, 1945, as Special Research Engineer on the special project involving the determination of the causes of cracks in welded ships.

c. Associate Professors

William David Pence (B.S., 1886, and C.E., 1895, University of Illinois) spent six years in railway practice after graduation, and then joined the staff at his alma mater serving successively as Instructor, Assistant Professor and Associate Professor from 1892 to 1899, showing marked ability as an instructor and administrator. He subsequently became successively Professor of Civil Engineering at Purdue University, Professor of Railway Engineering at the University of Wisconsin and also Engineer of the Wisconsin Tax Commission, and Valuation Engineer for the Interstate Commerce Commission in charge of the Central District office in Chicago. After retiring from the Commission in 1921, he became consulting engineer in Chicago, where he is still in active service. He is co-author with M.S. Ketchum of a textbook entitled "Surveying Manual". Professor Pence was awarded the Octave Chanute medal by the Western Society of Engineers in 1901 for a paper on "Thermal Expansion of Concrete". He served as President of the Indiana Engineering Society during 1903-05.

John Pascal Brooks (B.S. 1885, M.S. 1893, and Hon.Sc.D., 1915, Dartmouth College) spent his early experience in engineering practice after which he served as Instructor at Lehigh University from 1890 to 1897 and Professor of Civil Engineering at the University of Kentucky from 1897 to 1906. From 1906 to 1911, he was Associate Professor of Civil Engineering at the University of Illinois, resigning in 1911 to become President of Clarkson College of Technology, Potsdam, New York.

Thomas Douglas Mylrea (B.S., 1909, and C.E., 1922, University of Illinois) was engaged in engineering practice in the United States and Canada until September, 1922, when he came to Illinois as Assistant Professor of Structural Engineering. He was made Associate Professor in 1926, but resigned in September

1927, to accept a position as Professor of Building Construction at the Carnegie Institute of Technology. He remained in that position until 1934, when he became Professor of Civil Engineering and Head of the Division of Civil Engineering at the University of Delaware. Professor Mylrea is author of many articles in the engineering press.

William Horace Rayner (B.S., 1909, C.E., 1913, and M.S., 1920, University of Illinois) spent two years after graduation in engineering practice and joined the University in September, 1911, as Instructor in Civil Engineering. He became Associate in 1917, Assistant Professor in 1920, and Associate Professor in 1941. He is co-author with R.E.Davis and F.S.Foote of a textbook entitled "Surveying" and of another entitled "Elements of Surveying", and is sole author of one entitled "Surveying" and of another, "Advanced Surveying". Professor Rayner is author, also, of one circular of the Engineering Experiment Station.

William Albert Oliver (B.S., 1922, University of Michigan; M.S. 1928, and C.E., 1932, University of Illinois) taught at Beloit College during 1923-25 and at Case School of Applied Science during 1928-29, having been engaged in engineering practice the rest of the time after graduation until he joined the University of Illinois in 1929 as Instructor in Civil Engineering. He became Associate in 1933, Assistant Professor of Civil Engineering in 1936, and Associate Professor in 1943. He is co-author of one bulletin issued by the Engineering Experiment Station.

d. Assistant Professors

Jerome Sondericker (B.S., 1880, and C.E., 1883, University of Illinois) taught some of the subjects in civil engineering immediately after graduation at the University of Illinois, and in addition, gave instruction in projection geometry (elementary geometric drawing), descriptive geometry, and one or two classes in pure mathematics. He was just as excellent as a teacher as he had been as a student, and was held in high esteem by his students. After three years of advanced study during which time he served as Instructor, he was granted the degree of C.E. in 1883, and was made Assistant Professor of Engineering and Mathematics. He resigned from this position, however, in 1885, to accept an

appointment as Instructor in Applied Mechanics at the Massachusetts Institute of Technology, where for nineteen years, he was a distinguished member of the faculty of that institution. He was author of "Notes on Graphic Statics", and of many articles in the technical press. He died on July 22, 1904.

Arthur Newell Talbot See Chapters on Municipal and Sanitary Engineering and Theoretical and Applied Mechanics.

Milo Smith Ketchum See Deans, Chapter V.

Fred Goodrich Frink (B.S., 1886, University of Michigan; M.S., 1902, University of Chicago) served in practical engineering work from 1886 to 1890, then as teacher in secondary-school work from 1890 to 1897. He was then Professor of Civil Engineering at the University of Idaho from 1897 to 1900, and Instructor in Civil Engineering at the University of Michigan from 1902 to 1904. He was then made Assistant Professor of Civil Engineering at the University of Illinois, but withdrew in 1906 to take up commercial work

Frank Oliver Dufour (C.E., 1896, Lehigh University) served as Instructor at Lehigh during 1897-1902, as Professor of Civil Engineering at the University of Cincinnati during 1902-03, Acting Professor of Civil Engineering and in charge of Sanitary Engineering at the University of Wisconsin during 1903-04, Assistant Professor of Civil Engineering at the University of Vermont during 1904-05, and Assistant Professor of Structural Engineering at the University of Illinois during 1905-13. He resigned here in 1913 to accept a position with the Interstate Commerce Commission.

James Elmo Smith (B.S. 1902, University of Wisconsin; C.E., 1909, University of Illinois) spent several years in railroad practice, then came to the University of Illinois in 1907, as Assistant Professor of Civil Engineering. In addition to his duties at the University, Professor Smith served as Mayor of Urbana from 1919 until he resigned from the University in June, 1922. He returned to the University, however, in 1935 to take a position with the Physical Plant Department and has retained it to date.

Charles Wesley Malcolm (B.S., 1902, and C.E., 1906, University of Illinois)

served as Instructor in Civil Engineering here during 1902-06, as Associate during 1906-07, and as Assistant Professor during 1907-13. He resigned to join the editorial staff of the Engineering Record. He is author of a textbook entitled "Graphic Statics".

Frank Berry Sanborn (B.S., 1887, and C.E., 1889, Dartmouth College; M.S., 1898, Harvard University) was engaged in engineering practice for a number of years after graduation, then served as Assistant Professor of Civil Engineering at Tufts College during 1899-1901, and as Professor after 1901. It was during the year 1908-09 while Professor Baker was away on leave, that Professor Sanborn acted as Head of the Department of Civil Engineering here, serving with the title Assistant Professor. Professor Sanborn is author of a textbook entitled " Mechanics Problems for Engineering Students".

Allen Boyer McDaniel (B.S., 1901, Massachusetts Institute of Technology) was employed in engineering practice until 1906, when he became Instructor in Civil Engineering at Case School of Applied Science. After a year there he became Professor of Civil Engineering at the University of South Dakota and remained with that school until 1912. He then served as Assistant Professor of Civil Engineering at the University of Illinois during 1912-16. He resigned to accept an appointment as Head of the Department of Civil Engineering at Union College. He is author of a textbook entitled "Excavating Machinery", and of another "Earthwork, Parts I and II". He is author also of one bulletin of the Engineering Experiment Station here.

John Ira Parcel (B.S. 1903, Westfield College; B.S., 1909, University of Illinois) was Assistant Professor of Structural Engineering at the University here during the year 1913-14, having had several years' experience before that in structural work and teaching. He left the University to accept a position at the University of Minnesota.

Clarence Stanley Sale (B.S., 1906, Purdue University) followed engineering practice until 1913, when he served as editor on the staff of Dean Goss for the Chicago Association of Commerce Commission on Smoke Abatement and Electrification of Railways, during 1913-16. He continued with the College as Instructor in

Civil Engineering during 1915-17 and as Assistant Professor during 1917-18. During 1917-18, also, he was Assistant to the Director of the Engineering Experiment Station here. He resigned to enter commercial work.

Clyde Beethoven Pyle (B.S., 1911, and C.E., 1917, University of Pennsylvania) taught mechanics of materials and structures at the University of Pennsylvania during 1911-13. He was engaged in structural-engineering practice from 1913 to 1921, and came to the University of Illinois in September, 1921, as Assistant Professor of Structural Engineering. He left in August, 1922, to take up work again in structural-engineering practice.

Edward Ezra Bauer (B.S. 1919, C.E., 1927, and M.S., 1929, University of Illinois) joined the University staff in 1919 as Assistant in Civil Engineering. He became Instructor in 1920, Associate in 1929, and Assistant Professor in 1931. He is author of two textbooks entitled "Highway Materials" and "Plain Concrete".

Frank Whitworth Stubbs (B.S. 1921, and C.E., 1926, University of Colorado; M.S., 1932, University of Illinois) served as Instructor at the University of Colorado during 1921-23 and then was engaged in practice during 1923-26. He became Instructor in Civil Engineering at the University of Illinois in September, 1926, Associate in 1929, and Assistant Professor of Civil Engineering in 1931. He resigned in September, 1936, to become Professor of Civil Engineering and Head of the Department at Rhode Island State College, and has remained in that position to date. Professor Stubbs is author of a textbook entitled "Estimates and Cost of Construction". Although not published until 1938, much of the manuscript was written while Professor Stubbs was at the University of Illinois.

George Harper Dell (B.S. 1922, and C.E. 1926, Pennsylvania State College; M. S., 1931 and Ph.D., 1943, University of Illinois) was employed in engineering practice until he came to the University in September, 1927, as Instructor in Civil Engineering. He was made Associate in 1933, and Assistant Professor in 1941. Professor Dell's instructional field has been surveying, although he taught some classes in Civil Pilot Ground courses after that work was instituted in 1942. Professor Dell is author of one bulletin of the Engineering Experiment

Station.

Ralph Wendel Kluge (B.S. 1928, and M.S., 1930, University of Illinois) became Instructor in Civil Engineering here in September, 1930, and Special Research Assistant in February, 1931. He was made Instructor in Civil Engineering in February, 1934, and Special Research Associate in September, 1935. He was transferred to the Department of Theoretical and Applied Mechanics in December, 1936, with the title Special Research Associate in Theoretical and Applied Mechanics. He was given the rank of Special Research Assistant Professor in that Department in 1941, but resigned in October following. Professor Kluge is author of one bulletin and is co-author of six others published by the Engineering Experiment Station.

Ralph Brazelton Peck (C.E., 1934, and D.C.E., 1937, Rensselear Polytechnic Institute) was engaged in practical engineering work involving the design of engineering structures and foundations until he became Lecturer on Soil Mechanics at the University in September, 1942. He was made Research Assistant Professor in December, 1942. For a paper entitled "Earth-Pressure Measurements in Open Cuts of the Chicago Subway", Doctor Peck was honored in 1945 with the Norman medal, the highest award conferred by the American Society of Civil Engineers.

James Gordon Clark (B.S., 1935, and M.S., 1939, University of Illinois) served as Instructor in Civil Engineering at Oregon State College and was for a time engaged in engineering practice before coming to the University of Illinois as Instructor in Civil Engineering in September, 1936. He was made Associate in 1941, and Assistant Professor in 1943. He was given a leave of absence from November 1, 1944, until March 1, 1945, to take a position in structural design in the aircraft industry.

c. Associates

Lawrence Gilbert Parker (B.S. 1902, and C.E., 1907, University of Illinois) served as Instructor in the Department during 1902-07 and as Associate during 1907-10. He resigned to take up engineering practice.

Neal Bryant Garver (B.C.E., 1905, and C.E., 1911, Iowa State College) was

employed in structural engineering from 1905 to 1910, after which he came to the University of Illinois as Instructor in Civil Engineering. He was made Associate in 1913, and remained with the University until October, 1918, when he resigned to engage in practical work again.

Raymond Earl Davis (B.S., 1911, and C.E., 1914, University of Maine; M.S. 1916, University of Illinois) served as Instructor in Civil Engineering at the University of Illinois during 1911-17 and Associate during 1917-18. He resigned in January, 1918, to enter military service; but later joined the faculty of the University of California, and since 1926 has been Professor of Civil Engineering and Director of the Engineering Materials Laboratory there. He was granted the honorary degree of Dr.Eng. by the University of Maine in 1936. While at the University of Illinois, Mr. Davis was co-author of a textbook entitled "Manual of Surveying for Field and Office" and was author of one bulletin issued by the Engineering Experiment Station. Since leaving the University, he became co-author of other texts in the field of surveying.

Craig Potter Hazelet (B.S. 1915, University of Washington; B.S., 1918, Massachusetts Institute of Technology) was employed in engineering practice during 1915-17 and 1918-20. He came to the University of Illinois in 1920 as Instructor in Civil Engineering. He was made Associate in 1921, but left the University in October, 1922, to accept a position as Office Engineer of the Scherzer Rolling Lift Bridge Company of Chicago. Later, he became General Manager of this organization.

Henry Pritchard Evans, Jr. (B.S. 1932, Carnegie Institute of Technology; M.S. 1933, University of Iowa) spent three years in practical work after graduation, and then joined the staff at the University of Illinois in September, 1936, as Associate in Civil Engineering. He was given a leave of absence in July, 1942, to join the U.S.Armed Forces.

Alphonse Anthony Brielmaier (B.S., 1926, and C.E., 1929, Case School of Applied Science; M.S., 1930, University of Illinois) was appointed Associate in Civil Engineering at the University of Illinois in September, 1937, and remained in the Department until he resigned in June, 1943, to join the U.S. Army

Engineer Corps. Mr. Brielmaier is author of one circular issued by the Engineering Experiment Station.

Thomas LeRoy Speer (B.S., 1938, Armour Institute of Technology) was employed in engineering practice before joining the staff at the University of Illinois in September, 1943, as Special Research Associate in Soil Mechanics. He remained in the University until September, 1944.

Vail Hall Moore (B.S. 1933, University of Illinois) after some years in teaching and practical experience, served as Associate in Sanitary Engineering here during the second semester of 1943-44. In September, 1944, he was transferred to the Department of Physics.

Ahmet Munci Ozelsel (B.S., 1939, Roberts College; M.S., 1941, and Ph.D., 1944, University of Illinois) became Special Research Assistant in Civil Engineering at the University of Illinois in September, 1943, and Special Research Associate in September, 1945.

Thomas Hampton Thornburn, (B.S. in Chem., 1938, University of Illinois; Ph.D., 1941, Michigan State College) after a year in research with the Michigan State Highway Department and three years' service in the U.S. Army Air Forces, joined the University here in the fall of 1945, as Research Associate.

f. Lecturers

Albert Edward Cummings (B.S., 1921, and C.E., 1922, University of Wisconsin became Lecturer in Foundation Engineering at the University in September, 1941. He was not employed full time, but gave lectures whenever they could be arranged. He still maintains his connection in 1945.

William Homer Wisely, (B.S., 1928, and C.E. 1941, University of Illinois) while engaged as engineer in charge of administration and operation of the Urbana-Champaign Sanitary District, has served as Lecturer in Sanitary Engineering since the second semester of 1943-44.

<u>Frank Alfred Randall</u>, (B.S. 1905, and C.E., 1909, University of Illinois) Consulting Structural Engineer with offices in Chicago, was appointed Special Lecturer in Structural Engineering here in September, 1944. Mr. Randall has for some time been making an exhaustive study of Chicago buildings, with emphasis on structural developments during the entire history of the city.

<u>Karl Terzaghi</u> (Dr. Tech., 1911, Technische Hochschule, Graz, Austria) was employed in engineering practice in Europe during 1905-11 and in the United States during 1912-14. He was professor of Civil Engineering at Roberts College from 1915 to 1925 and Professor of Foundation Engineering at Massachusetts Institute of Technology from 1925 to 1929. He served as a professor in the Technische Hochschule in Vienna and as consulting engineer from 1929 to 1938. Since 1938, he has been Lecturer at Harvard University and since the fall of 1945, has in addition, been Lecturer at the University of Illinois. Doctor Terzaghi is author of "Morphologie und Hydrographie des Kroatischen Karstes", "Erdbaumechanik", and "Theoretical Soil Mechanics", and is co-author of "Ingenieurgeologie", "Theorie der Setzung von Tonschichten", and "Erdbaumechanik und Baupraxis". He is the leading world authority in the field of soil mechanics and in 1930, was awarded the Norman Medal of the American Society of Civil Engineers for his paper "The Science of Foundations - Its Present and Future".

g. Instructors and Research Assistants

<u>Alfred Leonhardt Kuehn</u> (B.S., 1900, University of Illinois) served as Instructor in the Department during 1900-02, after which he left to take a position in railway service, being Engineer Maintenance of Way for the C.C. & L. Railway from 1902 to 1904, Engineer of Maintenance of Way for the Big Four Railway from 1904 to 1906, and Superintendent of Way of that line from 1906 to 1909. Mr. Kuehn then joined the staff of the American Creosoting Company, in due time

becoming President of the organization with offices in Chicago.

Harlow Barton Kirkpatrick (B.S., 1901, University of Illinois) was Instructor in Civil Engineering here during the school year 1901-02, after which he took up engineering practice.

Louis Liston Tallyn (B.S., 1901, University of Illinois) served as Instructor in Civil Engineering here during 1901-02, after which he withdrew to enter railway service.

Roy Irving Webber (B.S., 1899, Purdue University; C.E., 1906, University of Illinois) spent the years 1899-02 in engineering practice, after which he served as Instructor in Civil Engineering at the University of Illinois during 1902-06. He withdrew to go to Pennsylvania State College as Assistant Professor of Structural Engineering. Later, he became Superintendent of Buildings and Grounds there, and retained that position until his death in May, 1929. He was author of Bulletin No.6 issued by the Engineering Experiment Station in 1906.

Leslie Abram Waterbury (B.S. in C.E., 1902, C.E.,1905, B.S., in A.E.,1915, and A.E., 1918, University of Illinois) served as Instructor in Mathematics and Civil Engineering at Michigan Agricultural College during 1902-03, and as Instructor in Civil Engineering at the University of Illinois during 1903-07. He resigned to take a position as Professor of Civil Engineering at the University of Arizona. He was author of a textbook entitled "A Vest Pocket Handbook of Mathematics", and of another "Cement Laboratory Manual" and of still another, "Laboratory Manual for the Use of Students". He died on June 15, 1918, at Nitro, West Virginia.

Banus Hutson Prater (B.S., 1903, University of Illinois) served as Instructor in the Department here during 1903-04. He then joined the staff of the Isthmian Canal Commission. In 1906, Mr. Prater became connected with the Oregon Short Line Railroad, which later was taken over by the Union Pacific System. He was advanced in position on that line until in 1925, he became Chief Engineer. He served in that capacity until 1932, when he was made District Engineer of the three western districts of the Union Pacific System. Since 1937,

he has been Chief Engineer of these lines.

Guy Henry Rump (B.S., 1904, and C.E., 1912, University of Illinois) was Instructor in Civil Engineering here for the academic year 1904-05, after which he took up engineering practice.

John Jefferson Richey (B.S., 1903, and C.E., 1910, University of Illinois) served as Instructor in the Department of Theoretical and Applied Mechanics during 1903-05. He then went into engineering practice, but returned to the University in 1907 to become Instructor in Civil Engineering. He resigned in September, 1912, to accept an appointment as Associate Professor of Civil Engineering at the Agricultural and Mechanical College of Texas.

Ralph Bethuel Slippy (B.S., 1903, and C.E., 1905, Cornell College, Iowa) served as Instructor in Civil Engineering at the University during 1906-10.

Charles Clinton Albright (B.S., 1903 and C.E., 1908, Purdue University) spent several years in engineering practice after graduation, then served as Instructor in Civil Engineering at the University during 1908-09. He resigned to accept a position at Purdue.

Archie Reed Alger (B.E., 1904, and C.E., 1911, Michigan Agricultural College) served as Instructor in Civil Engineering in Michigan Agricultural College during 1904-07 and in Case School of Applied Science during 1907-08. He was engaged in engineering practice during the next year, and came to the University of Illinois as Instructor in Civil Engineering in 1909. He remained here until 1913, when he withdrew to re-enter practical work.

Charles Elliott Henderson (B.S., 1906, University of Illinois) was employed in railway service until he joined the staff here in September, 1909, as Instructor in Civil Engineering. He withdrew at the end of that school year to return to engineering practice.

Jerome Goodspeed Van Zandt (B.S., 1904, Purdue University; C.E., 1907, University of Wisconsin) was engaged in engineering practice during 1904-06, and as a teacher of civil engineering in the University of Wisconsin and University of Southern California during 1906-10. He then joined the staff at the University

of Illinois in September, 1910, as Instructor in Civil Engineering, but resigned at the end of the school year to re-enter engineering practice.

George Innes Gay (B.S., 1909, and C.E., 1912, University of Colorado) served as Instructor in Civil Engineering at the University of Colorado during 1909-10, then came to the University with the same title. He withdrew at the end of the school year, however, to accept a position at the University of California.

Lockwood James Towne (Ph.B., 1905, Depauw University; B.S., 1909, Massachusetts Institute of Technology) followed engineering practice during 1909-10 and served as Adjunct Professor of Civil Engineering at the University of Nebraska during 1910-11. He then joined the staff here as Instructor in Civil Engineering, but at the end of the school year 1911-12, became Superintendent of Construction in the Office of Supervising Architect. He left to take up practice again.

Frank Morris Okey (B.C.E., 1904, Iowa State College) was employed in engineering practice until he joined the University staff here in 1911 as Instructor in Civil Engineering. After a year here, he accepted a position as Professor of Civil Engineering at Colorado College.

Guy G.Mills (B.S., 1912, University of Illinois) was engaged in practical work for a year after graduation, then joined the College staff here as Instructor in Civil Engineering. He served from December, 1913, to June, 1914, and from February to June, 1915. He withdrew finally to return to practice.

Camillo Weiss (C.E., 1910, Vienna Technischle Hochschule; M.S., 1917, University of Illinois) was employed from 1910 to 1917 as structural engineer with various firms in the United States, after which he served during the academic year 1917-18 as Instructor in Structural Engineering at the University of Illinois. He withdrew to return to practice.

Earl Wesley Carrier (B.S., 1918, University of Illinois) served as Instructor in Civil Engineering here from September, 1918, to June, 1920, after which he became associated with the Illinois Terminal Railroad.

Clyde Kelso Mathews (B.S., 1919, University of Kansas) was Instructor in

Surveying here from September, 1921 to September, 1924.

Walter Thompson Morrow (B.S., 1918, University of Colorado) became Instructor in Structural Engineering at the University of Illinois in September, 1921, and remained here until September, 1924.

Chauncey Brockway Schmeltzer (B.S., 1919, and M.S., 1920, University of Illinois) became Assistant in Surveying in 1920 and Instructor in September, 1921. He retained this position until September, 1926, when he withdrew to engage in engineering practice.

Harry Clow Boardman (B.S., 1910, and C.E., 1926, University of Illinois) was employed for several years in practical work, then joined the College staff here in September, 1924, as Instructor in Civil Engineering. He remained until September, 1926, when he accepted a position with the Chicago Bridge and Iron Works.

Roland Horton (B.S., 1921, University of Oklahoma) served as Instructor in Civil Engineering at the University here from September, 1924, to September, 1928.

Harold Theodore Larsen (B.S., 1923, and C.E., 1928, University of Illinois) was Instructor in Civil Engineering here from September, 1926, to September, 1927, when he resigned to join the editorial staff of the American Society of Civil Engineers.

Harold Everett Wessman (B.S., 1924, M.S., 1925, C.E., 1929, and Ph.D. 1936, University of Illinois) joined the University staff here as Instructor in Civil Engineering in September, 1927, after two years of experience in practice. He resigned in September, 1929, to accept a position in China. Since 1937, Doctor Wessman has been Chairman of the Department of Civil Engineering and Professor of Structural Engineering at New York University.

George Everette Spencer (B.S., 1927, Purdue University) was Instructor in Civil Engineering at the University of Maine during 1927-28, then joined the staff at the University of Illinois in September, 1928, as Instructor in Civil Engineering. He resigned at the end of the academic year to accept an appointment at Purdue.

Elmer Michael Loebs (B.S., 1928, Purdue University) taught a year at Purdue, then came to the University of Illinois in September, 1929, as Instructor in Civil Engineering. He resigned at the end of the school year, to engage in engineering practice.

Harry Edward Schlenz (B.S. 1927, M.S., 1929, and C.E., 1933, University of Illinois) was Instructor in Civil Engineering during 1929-30. He is co-author of one bulletin issued by the Engineering Experiment Station.

Wilfred Main Honour (B.S., 1929, Georgia Institute of Technology; M.S.,1932, University of Illinois) served as Special Research Assistant in Civil Engineering from September, 1929, to February, 1932.

Kenneth Clem Tippy (B.S., 1927, and M.S., 1931, University of Illinois) became Instructor in Civil Engineering here in September, 1930. He resigned in April, 1934, to accept a position with the U.S. Bureau of Reclamation.

Marvel Fred Lindeman (B.S., 1928, and M.S., 1930, University of Illinois)was Instructor in Civil Engineering from February to June, 1931.

Benn Joseph Leland (B.S. 1934, and M.S. 1936, University of Illinois) served as Research Assistant in Civil Engineering from March to June, 1934, and as Special Research Graduate Assistant in Civil Engineering during 1934-36. He is co-author of one bulletin of the Engineering Experiment Station.

Max Suter (Dipl.Ing., 1913, Federal Polytechnic School, Zurich, Switzerland; M.S., 1933, and Ph.D., 1935, University of Illinois) served as Special Research Assistant in Civil Engineering from January to June 1936.

Frank Peter Thomas (B.S.,1929, Carnegie Institute of Technology; M.S. 1931, University of Illinois) was Special Research Assistant in Civil Engineering from February, 1936, to March, 1937. He is co-author of two bulletins of the Engineering Experiment Station.

John Van Veghten Coombe (B.S., 1930, and M.S., 1933, University of Illinois) was appointed Special Research Assistant in Civil Engineering here effective in February, 1937, but resigned in December, 1940, to accept an appointment with the U.S.Navy. Mr. Coombe is joint author of three bulletins of the Engineering

Experiment Station.

Gordon Lutz Jeppesen (B.S., 1936, and M.S., 1938, University of Illinois) was made Instructor in Civil Engineering here in September, 1938, but resigned in September, 1939.

Charles Udell Kring (B.S., 1932, and M.S., 1939, University of Illinois) became Instructor in Civil Engineering in April, 1939, and resigned in June, 1939.

Thomas Hunter McCrackin, Jr. (B.S., 1940, University of Illinois) served as Special Research Assistant in Civil Engineering from September, 1940, to April 1, 1942, when he resigned to enlist in the U.S. Armed Forces. He is co-author of two bulletins of the Engineering Experiment Station.

David Hume Caldwell (B.S., 1938, University of California: M.S., 1940, and Ph. D., 1943, University of Illinois) joined the staff at the University in 1941 as Instructor in Civil Engineering. He resigned in 1943 to become Director of the Research Laboratory for the Bureau of Sanitary Engineering, California State Department of Health. Doctor Caldwell is co-author of two bulletins of the Engineering Experiment Station.

Walter Edmund Hanson (B.S., 1939, Kansas State College) became Instructor in Civil Engineering in February, 1942, for the remainder of that college year, but returned to the same position in February, 1946.

Mehmet Nejat Tokay, (See Theoretical and Applied Mechanics).

William Herman Munse, (B.S., 1942, and M.S., 1944, University of Illinois) was engaged in engineering practice until he joined the staff at the University here in September, 1943, to give one-third of his time as Instructor in Civil Engineering and two-thirds as Special Research Assistant in Civil Engineering. He withdrew from the University in September, 1944.

Clinton Paul Atkins, (B.S., 1942, University of Illinois) was employed in structural designing in industry until he accepted an appointment in September, 1945, as Special Research Assistant.

H. Summary

General - While Civil Engineering was one of the original four departments in engineering as it was organized shortly after the opening of the University, it has continued all through the years to be one of the major units of the College. The rapid advancements made in its installations of laboratory equipment and the numerous changes effected in its curricular programs are only reflections of progress as it has occurred in engineering practice in this particular field. While it is true that emphasis on special subjects has changed from time to time following developments in practice, the fact remains that the fundamental principles of training towards certain objectives have not altered to any considerable extent, and that the main purpose is still to provide a grade of instruction that will supply a body of men so grounded as to permit them to meet any social as well as engineering and economic problems that they may be called upon to attend.

The departmental staff has been active in experimental work as well as teaching, as the list of Station publications indicates, and its accomplishments in this direction have had a substantial influence in shaping improvements in the design, construction, and operation of engineering materials and engineering projects, in both public and private enterprise.

CHAPTER IX

THE DEPARTMENT OF ARCHITECTURE

A. ORGANIZATION

General - Although Architecture was one of the divisions in the Polytechnic Department recommended in the report made by the Regent and the four Trustees in 1867, it took some time to get the work established. No mention is made of any staff assigned to this Department until 1870-71, when the University Catalogue and Circular listed James Bellangee, M.S. with the title of Teacher of Architecture and Mechanical Drawing. Mr. Bellangee had spent a brief period as a draftsman in a Chicago office. That same issue of the Catalogue and Circular also contained an announcement of the School of Architecture as it was then called, with mention of a definite course of studies arranged for the instructional program, which was patterned very closely after Civil Engineering. In 1871, the work was taken over by Mr. Hansen who had spent two years at the Bau-Academie in Berlin. Mr. Hansen taught architectural drawing, and for one term, taught also a course in architectural design and rendering. In June, 1872, he went to Chicago to work for the summer, the fire there having occasioned the need for many men trained in architecture. On account of illness, however, he did not return in the fall, and a senior student named Nathan Clifford Ricker took charge of the work at the University, where he was graduated from his own department in the following March.

It is of interest to note that the 1870-71 issue of the Catalogue and Circular carried the statement that "This Department is for the present appended to the College of Engineering. Its studies embrace many of those belonging to the course in Civil Engineering. They include, also, Architectural Drawing, the principles and styles of Architecture, the history of Architecture, and plans and specifications for buildings of all kinds". While the School or Department continued as a nominal unit of the College, it did not become a well-established organization until October, 1873, when young Ricker returned to the University to take charge of the School with the title of Instructor in Architecture.

Throughout the years, the Department developed very rapidly, and in 1890, there was added the Division of Architectural Engineering, the first of its kind in this country, to provide training in the engineering features of building design and construction.

B. OBJECTIVES AND METHODS OF INSTRUCTION

Objectives - As stated in the 1872-73 issue of the University Catalogue[1] and Circular:

"This school is designed for those who desire to fit themselves for the profession of Architect or Builder. The specialties of the Course are taught upon the same general plan as in the European Art Schools, by a gentleman[2] of much practical experience, who is now studying in Berlin, but is expected to return this year. The History of Architecture is taught by Lectures during the second and third years, and it is arranged to give Carpenters, Builders and Masons, not able to take a full Architectural Course, the opportunity of getting the whole history of Architecture in one year, besides instruction in Architectural Drawing. The principles of the different styles of Architecture are taught partly by lectures, but chiefly by drawing exercises".

A publication issued in 1899-1900[3] outlined the objectives of the Department as follows:

1. To prepare young architects thoroughly for the actual conditions and requirements of American Practice.

2. To give a thorough training in construction.

3. To gather from history of past architecture, ideas that are suggestive and useful now.

4. To develop and cultivate power in design as fully as possible.

As stated also in a still later publication:[4] "The primary aim of the course in architecture is to fit the student to conceive and design buildings which shall be at once thoughtful and beautiful. The aim of the course in Architectural Engineering is to train the student thoroughly in the scientific determination and verification of structural methods. The subjects studied must be largely the same, but emphasis and method of treatment are and should be different".

Departmental Divisions - As the professional field expanded and as the

---

1 Page 36
2 Young Nathan C. Ricker
3 "Circular of the Department of Architecture, 1899-1900", page 6.
4."University of Illinois, The Department of Architecture: Development, Conditions, Ideals", by Sidney F. Kimball, 1913.

enrollment in architecture grew in response to the demand for men trained in this particular line, the work in the department began to shape itself into divisions so that in about 1924, there existed the divisions of design, freehand drawing, architectural engineering, history of architecture, and construction, each under the direction of ~~one~~ a member of the staff. Optional curricula were offered in architecture and architectural engineering until 1930-31, when three options were announced: namely, design, construction, and general architecture, each with a number of divisions of study. This was later reduced to two: namely, general option for students seeking a degree in architecture, and construction option for students ~~seeking a degree in architecture, and construction option for students~~ working for a degree in architectural engineering.

<u>The Competitive System in Architectural Design</u> - For a number of years now, the work in Architectural Design has been conducted under an arrangement of competitive conditions. The following description taken from the Architectural Year Book of 1916,[1] explains the procedure as practiced at that time.

"The work in (architectural) design of the last three years is not divided into courses of fixed duration, but into six stages of a fixed degree of difficulty, through which the students advance in varying lengths of time, depending on their ability and success. The first three grades are devoted primarily to the study of simple architectural units; the general elements of facades -- bays, pavilions, loggias, and so on; the general elements of the plans -- vestibules, porticoes, stairways, and other means of circulation. The three upper grades are devoted primarily to the study of composition, using these elements, in the design of complete buildings of increasing extent and complexity. Problems are of two chief kinds; rendered problems lasting several weeks, in which mature study is given and somewhat elaborate drawings are made, representing the subject with essential completeness; sketch problems of a week or less, in which an idea is presented in a more summary way.

"All these problems are competitive, based on a set of common requirements to which each man must conform. The drawings are graded by a jury composed of all the instructors in design, avoiding any injustice through personal idiosyncrasy or favoritism. Immediately after the judgment, while the difficulties of the problems are still fresh in mind, the drawings are hung in the exhibition hall of the department to enable the students to compare solutions and progress.

"The awards given in the problems are 'Pass', which denotes an average standard of excellence, 'Mention', and "Mention Commended', which denote successive degrees of distinguished excellence. For very exceptional work a still higher recompense, the 'Medal' is given".

An accumulative point system for the design courses was developed for rating the rendered exercises that conformed to the University grading plan

1 Page 10.

established for evaluating student performance, first according to the original numerical schedule and later according to the literal scheme which became effective in 1917.

In order to secure the benefits of decisions by an impartial jury having no local interest, the Department of Architecture here in 1922, decided to accept the plan maintained by the Beaux Arts Institute of Design in New York City whereby its students could compete with those from other architectural schools in the United States in the submission of problems assigned under that system. In pursuance of this policy, the accumulative point system then in effect for grading the students' work as well as for the administrative records of the Department, was carefully revised to represent the schedule and awards of the Institute while conforming to the University regulations for reporting grades.

In carrying out the plan, a semester's work is assumed to be of fifteen weeks duration regardless of the actual calendar time assigned to it. A certain number of weeks of credit is allotted to each B.A.I.D. projet, which corresponds as closely as possible to the actual time spent in developing the problem. A valuation representing a certain number of points a week is assigned to each award as given by the Institute. The number of points gained by a student on a projet is found by multiplying the allotted number of weeks on a projet by the number of points a week assigned to the award. The assignment of points to B.A.I.D. awards in class A, for example, are: 1st Medal, 8 points a week; 2nd Medal, 7 points a week; 1st Mention, 6 points a week; and 2nd Mention, 5 points a week. A total of 90 points or more for a semester's grade is equivalent to an A grade in the University schedule; 80-89, B; 70-79, C; 60-69, D; and below 60, E. The ratings for Class B and other projets are figured on a similar basis.[1]

Under this system of competition, rivalry between schools of the country in securing recognition for student production has become very keen. For obvious reasons, each department is anxious to have its students receive the highest awards; and no doubt, students are inspired to do better work when they know their product will be judged in a nation-wide contest, but the scheme does place a

1 From a memorandum record in the office of the Department of Architecture at the University of Illinois.

heavy responsibility upon the instructors in charge of the assignments.

C. BUILDING AND ROOM ACCOMODATIONS

Room Assignments for Class and Drawing-Room Work - The first classes in architecture met in the Old University Building until University Hall was opened in December, 1873, when the Department was assigned to the northeast tower room on the fourth floor. Later, the next room became available. When the number of students had increased to 65, the Department was transferred to three rooms on the fifth or top floor of the east wing. It remained in these quarters until the fall of 1894,[1] when it was installed on the fourth floor of the new Engineering Hall in quarters which it occupied during the most of the remainder of its stay in the College of Engineering. It utilized practically the entire space on this floor, which was divided into class rooms, drafting rooms, private studios, or offices for the teaching staff,[2] a blue-print laboratory, a photo studio, a seminary room, a lecture room, a museum, and a cabinet room.

The photo studio and the blueprint laboratory were in the southwest corner of the west wing, the photo studio being equipped with a number of cameras and a dark room, and the blueprint laboratory consisting of an office, a sensitizing room, and a printing room. The printing room was supplied with a printing frame, with developing sinks, and a drying frame.

The lecture room, Room 418, was fitted with a stepped floor and had a seating capacity of seventy-five. It was supplied with an electric-arc lantern of the latest and most approved design.

The cabinet room contained about 1,200 slides, all listed in a card index system for convenience.

At the beginning of the second semester, 1927-28, the department moved into its new building on the south campus, vacating all but two of its rooms formerly occupied in Engineering Hall. These new quarters provided additional space and much better working arrangements and facilities than was possible to have in Engineering Hall. The new building for Architecture and Kindred Subjects, is shared by the Department of Art, formerly known as Art and Design.

1 See The Technograph, 1894-95, Pages 174-175
2 Professor Ricker occupied Room 402 for an office from 1894 to 1912.

The first or ground floor is devoted to work in modeling, graduate design, and as quarters for the Architectural Club. The west end of the second or main floor houses the Hall of Casts, which contains a fine collection of reproductions of sculpture, architectural motifs, and casts from antiques. At the east end of this floor is the exhibition gallery which at different times houses loan collections and student and faculty exhibits. The north side of the north wing is used as a lecture room, while the middle portion of this floor is occupied by offices. The third floor has a large drawing room at each end. The Ricker Library occupies the north wing, and offices the middle portion. The fourth floor is also occupied by drawing rooms and offices, while the top floor is devoted to freehand drawing, water-color, and other studios.

D. DEVELOPMENT OF DEPARTMENTAL FACILITIES AND EQUIPMENT

Collection of Casts - The University Catalogue and Circular of 1874-75 stated: "The school possesses a fine collection of plaster casts, 150 in number, made by Christian Lehr, Berlin, mostly from architectural subjects, for use in the drawing classes, besides those in the Art Gallery". The Department continued to add to the collection from time to time although there was only limited space for storage. In 1928, however, when it moved into its new quarters, it was able to extend the collection very materially; and in 1931, when it joined the College of Fine and Applied Arts, it had assembled a fine assortment of models of structural ornament and design and casts of famous statuary and historic buildings.

Ricker Library of Architecture - A good library serves a double purpose in any department of architecture. It is to architectural students all that any library is to the general student -- a source of the literary contributions of the best writers of all periods; and in addition, it is a depository of illustrations -- printed, photographic, and plastic -- of the architectural library master-pieces of the ages. An architectural library for architectural students is somewhat as surveying instruments and testing machines are to civil engineering students, and the shop and power laboratories to mechanical engineering students.

After Professor Ricker was appointed Head of the Department of Architecture in 1873, he asked for and received $500 for the purchase of books; and each year thereafter, he used as much as he could out of his meager allowances for the Department for the purchase of books. At first, he housed these books in his own office in University Hall, but later, when the Department moved to the top floor of that building, he transferred them to a room adjoining the combination recitation and drafting room located in one of the towers, where they were accessible to students at all working hours of the day. There were about 700 volumes at that time.

For many years, Professor Ricker clipped engravings from architectural journals, mounted them upon cardboard, and indexed them all with his own hands. As money was available, he bought unmounted photographs and mounted and indexed them, again by his own indefatigable personal efforts.

When the Department moved to the top floor of Engineering Hall in 1894, it kept its books and plates in a portion of one small room, Room 403. In 1903, however, it took over for the use of the departmental library, Room 400, the large room formerly occupied for drafting purposes, and assigned a trained librarian to part-time service in charge of the books, plates, and the collection of lantern slides.

In 1910, the Architectural Library was enlarged and removed into quarters that extended partially across the central wing at the north end of the north corridor on the top floor[1] of Engineering Hall, and a full-time librarian was employed. With new book shelves, a complete card filing index and plenty of light, the Library took on added importance to the Department. New and rare and old books were added from time to time as appropriations permitted. The library continued to be to Architecture what the Engineering Library and the laboratory equipment was to other departments in the College of Engineering. Collections of mounted plates and photographs, lantern slides, and classified portfolios of illustrative materials were added whenever possible. The outstanding current

1 This space was made available by throwing the three north rooms, a classroom, studio, and office into one large room about 25 by 68 feet in plan.

periodicals on architecture and related subjects were also available.

A pamphlet entitled "The Department of Architecture: Development, Condition, and Ideals", published in 1913 by Sidney F.Kimball, Instructor in Architecture, contains this statement regarding the Architectural Library: "The really invaluable resource of the school is its superb collection of architectural books. The solid range of folios, which must serve as a substitute for the surroundings of students in Paris or Rome, are probably surpassed in but a single architectural school of America. The Avery Library of Columbia is thought to be the most complete of all special libraries of architecture, and is undoubtedly the first in America for research in architectural history. It may be doubted, however, whether even the Avery Library is superior to the Library at Illinois for serving the prime function of a school collection, the furnishing of precedent and inspiritation for design".[1]

In 1916, when the collection consisted of about 3,600 volumes, the whole of the top floor in this north wing was assigned to the use of the Library -- a space about 70 feet square.

In January, 1917, by authority of the Board of Trustees, the Library was formally named the Ricker Library of Architecture. Formal dedication exercises were held in the library on May 23, following at a convocation held to commemorate the forty-third anniversary of the connection of Dr. C. N. Ricker with the Department. At this meeting, the staff of the Department of Architecture presented to the Library a bronze tablet marking the dedication of the library to the memory of Doctor Ricker. The tablet contained the following statement:

RICKER LIBRARY
OF ARCHITECTURE
IN RECOGNITION OF
HIS FORTY-THREE
YEARS OF ACTIVE SERVICE
IN THE DEPARTMENT
OF ARCHITECTURE

1 Page 5.

THIS LIBRARY IS

DEDICATED TO

NATHAN CLIFFORD

RICKER
M C M X V I I

At this convocation, Professor Newton A. Wells presented a mosaic portrait of Professor Ricker; and the Alpha Rho Chi, organization of architectural students, presented a plaster bust of Professor Ricker, which was later cast in bronze.

In 1920, the Library contained about 8,000 bound volumes, 11,000 lantern slides, 15,000 mounted plates and photographs, 5,000 samples of American woods, 350 plaster casts of statues and architectural details, and numerous drawings and other materials useful in the teaching of architecture. So far as volumes were concerned, it was the second largest architectural library in this country. It was the only architectural library in which a student could work upon drawing boards with the open books around him. The Avery Architectural Library of Columbia University, by some said to be the most complete of all the architectural libraries in the world, as previously stated, had more books than the Ricker Library; but it was virtually only a reference or really a circulating library, and students were not permitted to use drawing materials in it. In the Ricker Library the books were all placed in open stacks and in unlocked cases, and were easily accessible; and a competent attendant was ever ready to help the students find what they wanted. It is doubtful whether even the Avery Library was superior to the Ricker Library for serving the prime function of a college collection -- the furnishing of precedent and inspiration in design.

When the building for Architecture and Kindred Subjects was completed in 1928, the Ricker Library of Architecture was transferred to that new location; and up to 1931, when the Department of Architecture became a part of the College of Fine and Applied Art, the Ricker Library had accumulated about 12,000 volumes. These publications contained works on biography, decoration, painting, theory, periods and styles, travel and description, city planning, and architectural competitions that had been held the world over.

Lantern Slides, Mounted Photographs, and Working Drawings - The Department gradually brought together an unusual collection of lantern slides and mounted photographs for use in connection with lectures illustrating the history of the architecture of all nations. The collection included views of government buildings, schools, churches, theaters, business houses, apartments, and single residences, all classified and indexed for ready reference. In 1900, there were 2600 slides; in 1903, 6,000; in 1913, 10,000; and in 1931, when the Department was transferred to the College of Fine and Applied Arts, 11,500. The collection of classified photographs, photogravures, engravings, plates, and drawings, many of which were mounted by Professor Ricker himself, totaled about 15,000 in 1931. In addition, the Department has been supplied with a long list of working drawings furnished by individuals and firms engaged in architectural practice for reference use in connection with drawing-room assignments.

Wood Shop - Classes in architectural shop practice were held in the Mechanical Building and Drill Hall. According to The Technograph,[1] the shop occupied about half of the first floor of that building and was equipped with thirty benches each provided with a full set of tools, ten power lathes with the necessary turning tools, a large planer, and a number of power saws. This separate woodshop for architects was discontinued after September, 1895, when the architectural shop was merged with the mechanical-engineering shop.

Architectural Shop Equipment - The 1874-75 Catalogue stated on page 36:

> "The Carpenter shop is fitted up for the regular shop practice of students in architecture. It contains a Whitney Planer, a moulding Machine, a Tenoning Machine, a Jigsaw, Cutting off and Slitting saws, a Morticing Machine, a Yankee Whitler, a Turning Lathe, a Foot Lathe, with saws, drills, taps, dies, etc., and three power Grindstones. Ten work benches with six sets of bench tools, and six sets of tools for making models. Also a small dry kiln built on an improved plan."

The University Catalogue of 1892-93 stated: "The architectural workshops in the same building with the mechanical laboratory are fully equipped for bench and lathe work, and are supplied with all essential machine tools. Students become familiar with the tools and with the work of the carpenter and cabinet-maker, as well as with the draughting operations of the architect's office".

---

1 1894-95, page 175.

E. MISCELLANEOUS

Student Enrollment in Architecture - In 1902 the number enrolled in professional courses in the Department of Architecture, reached 83; in 1907, 140; and in the fall of 1912, 332. For a time, the Department had the largest enrollment of the departments in the College of Engineering, and for some time, too, it had the largest enrollment of all the architectural schools in America. The most interesting feature was the relatively large number of students from outside the State -- the measure of the reputation the Department had attained. In 1912, two-fifths of the students in the Department came from outside the State -- the University's ratio being only half that proportion.

The Department becomes a Member of the Association of Collegiate Schools of Architecture - The Department of Architecture became a member of the Association of Collegiate Schools of Architecture in 1912-13. Other members of the Association were the University of California, the University of Michigan, Washington University, Massachusetts Institute of Technology, Carnegie Institute of Technology, University of Pennsylvania, Columbia University, Cornell University, and Harvard University. Syracuse University became a member in 1914-15. The purpose of the organization was to develop a close association of all the leading schools of architecture in the country, offering an opportunity at its annual meetings to discuss the various problems confronting the departments. In order to become a member of the association, a school must have had an approved four-year curriculum in architecture for at least four years, with minimum standard requirements as to the amount of time spent upon design, freehand work, construction, engineering and cultural courses.

Relations with the Illinois Chapters of the American Institute of Architects - The Department has always had the undivided support of the Chicago and the Central Illinois Chapters of the American Institute of Architects. This relationship has been the means for bringing to the campus many men of distinction to lecture before student bodies on subjects of interest to the profession and for making such contacts as have enabled students to secure positions in architectural practice.

Contributions to State Development - "It is difficult to estimate the influence this department has exerted in creating a demand for the construction of safe, comfortable, convenient, and artistic buildings in the State, but it has undoubtedly been large, for the graduates of the department are widely scattered, and each of them has left his impress upon the community in which he lives.

"The Department of Architecture has participated in many activities for the betterment of building conditions of the State. It was concerned with the passage of the law for the licensing of architects, and for more than twenty years it has had a representative on the Board of Examiners; it has advocated the construction of better buildings throughout the State; and it has cooperated in the solution of problems connected with civic improvements. In 1917, when a portion of the City of Mattoon was destroyed by a tornado, this department prepared drawings for the reconstruction of the devastated area".[1]

F. MUSEUM MATERIALS AND COLLECTIONS

Art Gallery - Because portions of the Art Gallery were used extensively for instructional purposes by the Department of Architecture, The Gallery is described in some detail. The Catalogue and Circular of 1884-85 stated the following:[2]

"The University Art Gallery is one of the largest and finest in the West. It was the gift of citizens of Champaign and Urbana. It occupies a beautiful hall 61 x 79 feet and the large display of art subjects has surprised and delighted all visitors. In sculpture it embraces thirteen full-size casts of celebrated statues, including the Laocoon group, the Venus of Milo, forty statues of reduced size, and a large number of busts, ancient and modern, bas reliefs, etc., making over four hundred pieces. It includes also hundreds of large autotypes, photographs, and fine engravings representing many of the great masterpieces of painting of nearly all of the modern schools. Also a gallery of of historical portraits, mostly large French lithographs of peculiar fineness, copied from the great national portrait galleries of France".

Museum Materials - When the Department moved into the top floor of Engineering Hall in December, 1894, it took one of the large rooms in the north wing for a museum. From various accounts, it is evident that this museum contained many valuable specimens of raw and finished building materials, including a fine collection of moulded and pressed bricks and of panels of mosaic construction,

1 "A Discussion of the Development and Needs of the College of Engineering and the the Engineering Experiment Station", November 25, 1918.
2 Page 17.

which were contributed by the manufacturers. It also contained a good collection of fixtures, models, and working drawings of finished buildings.

G. THE DEPARTMENT JOINS THE COLLEGE OF FINE AND APPLIED ARTS

The Department of Architecture joins the College of Fine and Applied Arts - On March 12, 1931, the Board of Trustees authorized the formation of a College of Fine and Applied Arts with the Department of Architecture as one of the components -- the others being the Department of Art and Design of the College of Liberal Arts and Sciences, the Division of Landscape Architecture of the College of Agriculture, and the School of Music. As a result, beginning on September 1, 1931, the administration of the Department of Architecture passed automatically to the College of Fine and Applied Arts. Thus, one of the largest departments in the College of Engineering withdrew after having been associated with it since the founding of the University in 1868. Up to that time, between one-fourth and one-fifth of the enrollment in the College had been made up of students in architecture or architectural engineering.

H. FACULTY PERSONNEL

General - Brief biographical sketches of faculty members above the grade of Assistant that were connected with the Department of Architecture at some period between the time of opening of the University and the year 1931, when the Department joined the College of Fine and Applied Arts, are listed in the following pages in chronological order according to rank.

a. Heads of the Department

General - Nathan Clifford Ricker served as Head[1] until 1910. Frederick Maynard Mann followed and was Head until 1913, when Loring Harvey Provine became Acting Head and later Head of the Department. Short biographical sketches of these men follow in the next few pages.

Nathan Clifford Ricker, the founder of the Department of Architecture and Dean of the College of Engineering from 1878 to 1905, was born on a farm near

1 During the academic year 1871-72 the University employed an "Instructor in Architecture and Free Hand Drawing", but the work consisted only of elementary geometrical drawing and a little artistic picture making. The first real instruction in architecture was in the fall of 1873, when N. Clifford Ricker was placed in charge of the Department of Architecture.

Acton, Maine, in 1843. He taught a country school in 1861 and again in 1862. For several years, he worked as a carpenter, wagon maker, mill wright, and later as a maker of piano cases, when they were made mostly by hand. Through all this time, young Ricker devoted his evenings and spare time to study. In 1867, he migrated to La Harpe, Illinois, and for a year and a half engaged as a carpenter in building dwellings and barns in that vicinity. Later, he purchased a half interest in a wagon and blacksmith shop, and operated it for one and a half years. After meeting a student of the University who was home on Christmas vacation, he sent for a catalogue of the University; and liking the prospect, sold his shop, and set out with $750 of hard-earned money in his pocket to get an education in architecture. On January 2, 1870, young Ricker arrived at the University. Note the promptness of the action! He received considerable advance credit in Latin, French, and some of the sciences, which he had earned while studying alone. He was one of a considerable number of men of mature age and more or less general education who came comparatively early to the University because of the new kind of education offered and because of the opportunity for remunerative labor; but he is the most noted of such students. In the summer of 1870, he made the wood work for a light spring wagon for the University -- a second student doing the iron work, and a third the painting.[1] During the year 1871, he was made foreman of the University carpenter repair-shop.

On account of his ability and integrity, student Ricker early secured the confidence and respect of both faculty and students. Although he found that the University offered no technical training in architecture, he was not in the least discouraged, but was most untiring of his private study of that subject. He arranged a four-year curriculum of instruction in architecture even while he was a student, for his future employment as head of the Department of Architecture had been agreed upon; and this curriculum was printed in the Catalogue of 1871-72, along with the several other curricula in engineering, agriculture, science, and languages -- the first definite curricula published by the

1 After fifty years of continuous use, the wagon was still in good condition, although eventually it had to be retired.

University.[1] The fundamental idea of Professor Ricker's curriculum was that the architect should be, first, a safe and economical builder; second, a man of business ability; and third, a designer.

During the first six months of 1872, Mr. Ricker worked in the office of J. W. Roberts, architect in Chicago, but returned to the University in time for the opening of the fall term of that year. The story was current among students that he selected his own subjects, taught himself, examined himself, and reported his own grades. At that time he read both French and German fluently, and much of his study was of literature in those languages. Although only a senior, he took temporary charge of the Department of Architecture in September, 1872, and remained in charge for the next two terms, receiving the B.S. degree in Architecture in March, 1873 -- the end of the second term -- having completed the work in a little over three years' time. Immediately after graduation, the Regent offered him a permanent instructorship with the understanding that he would go abroad for further study. At once he started for Europe and spent six months in travel and study there, visiting Paris, London, Berlin, and other cities for the purpose of studying their architectural monuments. Three months of the time were spent as a student at the Bau-Akademie in Berlin. He visited the International Exposition in Vienna, and was greatly impressed with the exhibit of shop work from the Imperial Technical School of Moscow, Russia; and upon his return to the University in September, 1873, as Instructor in Architecture, he introduced this so-called Russian system of shop practice into the architectural shop of the University of Illinois. This was the first use of a system that ultimately became almost universal in this country. In June, 1875, he became Assistant Professor of Architecture, and in June, 1878, Professor of Architecture.

For many years, Professor Ricker was the sole instructor in his Department, but in time he was able to secure the services of Mr. Joseph Corson Llewellyn, a graduate in architecture here in 1877, as Assistant in Architecture and Foreman of the general carpenter Shop. In 1877, the salary of the position was reduced,

1 At that time there were but two institutions in this country giving instruction in architecture -- Massachusetts Institute of Technology and Cornell University, the first of which established a course in 1868 and the latter in 1871.

however, and Mr. Llewellyn resigned during the next academic year. After that, a student, Mr. Nelson S. Spencer, who was graduated from the architectural curriculum in 1882, was appointed as part-time Foreman of the Carpenter Shop. In 1877, Professor Ricker, in addition to his regular teaching duties, began his work as architect of the new chemical building, now known as Harker Hall. For his services in connection with the design and construction of this building that cost $40,000, he received an extra $120. In 1878, Professor Ricker received the degree of Master of Architecture from the University.

In 1882, Mr. George W. Parker, a skilled mechanic, was made Foreman of the Carpenter Shop; and from 1883 to 1895, he was also Instructor in Wood-work. Professor Ricker had no other help with the technical work of his department, except that during the year 1889 he had one-third of an assistant's time, in spite of the fact that during those latter years he was engaged as architect and superintendent of the new drill hall, now known as the Gymnasium Annex. Because the legislative appropriation was wholly inadequate to meet the needs, Professor Ricker designed and redesigned the building several times to get a structure that could be built with the funds available. For his extra services in this connection he was allowed $350. He was also architect for the original or first unit of the Natural History Building completed in 1892; and with Professor J. M. White, who became a full-time assistant in 1890, he was architect for the library building, now Altgeld Hall. In partial recognition of all these and other services, the University conferred upon Professor Ricker in 1900 the honorary degree of Doctor of Architecture.

Even though architecture was a new field for a college curriculum, the attendance in that department at the University of Illinois was a high commendation of the insight and ability of Professor Ricker. Ever since the establishment of the Department the attendance had been among the largest in the country; and in 1910 when Doctor Ricker relinquished the administration of the Department there were 230 architectural students, more than in any one of the fifteen other institutions in this country then giving instruction in architecture.

Doctor Ricker always worked persistently for his students and the

up-building of the Department of Architecture. For years he had his desk in the drawing room with his students, was always accessible to every one, and was ever patient and persevering in helping students. He clipped engravings from technical journals, pasted them upon cards, and filed them with his own hands, to increase the facilities offered to his students. He translated nineteen volumes from German and twenty-one from French, typed them, and deposited them in the Library to increase the facilities of his department. He worked day and night in school time, and usually also in vacation; and if he did take a vacation, he often took with him some work to be done -- a book to be translated or some tables to be computed.

Professor Ricker prepared many sets of lectures for his students, had them copied by the blueprint process and sold to the students. The first of such lectures was published in 1885 as a book entitled "Elementary Graphical Statics and Construction of Trussed Roofs", which consisted mainly of the application of graphical processes to finding the stresses in roof trusses, it being one of the early publications on graphical analysis. This was the first book published by any one while connected with the University, Regents Gregory and Peabody having published one or more volumes before coming to the University. In 1912, he published a "Treatise on Design and Construction of Roofs", and in 1913, he produced a volume "Simplified Formulas and Tables for Floors, Joists and Beams; Roofs, Rafters, and Purlins". He was author, also, of three bulletins published by the Engineering Experiment Station.

From 1897 to 1917, Professor Ricker was a member of the Illinois Board of Examiners for Architects, serving as President of the Board from 1899 to 1917. During 1911-12, in addition, he was Chairman of the Commission to Codify the Building Laws of Illinois.

At a meeting marking the formal installation of Dean Goss on February 5, 1908, the Faculty presented to Doctor Ricker a magnificently-bound volume of the works of William Morris, President James making the presentation address. On November 4, 1913, a dinner was given to Professor Ricker by the department heads in the College of Engineering commemorating his forty years of service at the

University. On November 8, 1913, Professor Ricker was honored by a special convocation in recognition of his long period of faithful and efficient services to the University. The significant devotion of the man to his work is illustrated by the fact that in view of the immense amount of work he had to do, he did not have time to attend the meeting, even when it was held in his own honor.

Although Professor Ricker had given up the active direction of his Department in June, 1910, as previously stated, he continued in the Department until he retired on September 1, 1916, upon a Carnegie allowance, when he became Professor of Architecture, Emeritus. Altogether he had taught in the Department for forty-three years, had directed the affairs of the Department for thirty-seven years, and had been Dean of the College for twenty-seven years. Under his leadership, the Department had become one of the foremost in the country. The present Ricker Library is due largely to his unremitting zeal, for it was one of his main interests. No member of the faculty of the College ever gave to the University his time and effort more unstintingly than Doctor Ricker, and none was ever a more untiring worker. The University is everlastingly indebted to this pioneer, for it was due to his patient and persistent efforts that there was developed here a Department of Architecture that was second to none in the country. In March 15, 1922, the University further honored Doctor Ricker by holding a Convocation under the auspices of the College of Engineering -- the occasion marking his fifty years of service to the University. Futher mention of this occurs in a later chapter describing Engineers' Day.

Professor Ricker continued to live in Urbana until his death on March 19, 1924, which resulted from a fall on the preceding day.

Frederick Maynard Mann was born on May 1, 1868, at New York City. He received the B.C.E. in 1892, and the C.E. degree in 1898 at the University of Minnesota. In addition, he received the S.B. in 1894 and the M.S. in 1896 at the Massachusetts Institute of Technology. He served as Instructor in Architecture at the University of Pennsylvania during 1896-01, and practiced his profession in Philadelphia from 1898 to 1902. He then went to Washington University, St. Louis, where he served as Professor of Architecture from 1902 to 1910. It was in

1910, that he became Professor of Architecture and Head of the Department at the University of Illinois.

Until somewhere near the year that Professor Mann began work at Illinois, there had been considerable variety in the objects and the methods of the various architectural schools of the country, since each reflected the character if the training, usually European, obtained by its directing head; but at about that time the leading practicing architects manifested great interest in architectural education and made through the American Institute of Architects certain recommendations concerning the contents and the methods of the curricula of architectural schools. An Association of Collegiate Architectural Schools was formed to study the subject, and after deliberation recommended the outline of an architectural curriculum, which was adopted by most of the architectural schools as rapidly as local circumstances would permit. During his administration at Illinois, Professor Mann introduced this unified course. He resigned in June, 1913, to accept a similar position at his alma mater, the University of Minnesota.

<u>Loring Harvey Provine</u> was born on August 18, 1880, at Quincy, Illinois. He received the B.S. degree in Architectural Engineering in 1903 and the A.E. degree in 1909 at the University of Illinois. Following graduation, young Provine practiced as an architectural engineer in Chicago, St.Paul, Boston, Seattle, and Los Angeles for ten years. He was Superintendent of Construction of the buildings of the Big Creek Hydroelectric Development of the Pacific Light and Power Corporation in Southern California; and was in charge of the design and estimates for the superstructure of the power house of the Mississippi River Power Development at Keokuk, Iowa. In June, 1913, Mr. Provine became Professor of Architectural Engineering and Acting Head of the Department at the University of Illinois, and in 1920, became Head of the Department. He has been active in the Collegiate Association of Architectural Schools, and has maintained high standards for the Department of Architecture. When the Department was transferred to the College of Fine and Applied Arts in 1931, Professor Provine continued as Head of his Department, and has continued as such to date (1945).

b. Other Professors

James McLaren White. See Deans, Chapter V, page 117.

Newton Alonzo Wells (B.P.1877, Syracuse University) studied extensively abroad after graduation, then served as a teacher in Union College, Syracuse University and in Western Reserve University. About the time the University Library Building (now Altgeld Hall) was completed in 1897, a competition was held for decorative paintings, for the new building, and the award went to Mr. Wells, then an artist and teacher in Paris. After he had finished his assignment on the building, he became Professor of the History and Practice of Painting in the College of Literature and Arts in the University. In 1903, he was made Professor of Architectural Decoration in the College of Engineering.

He was a man of unusual ability, his work outside the classroom being represented by oil paintings, water-color studies, and pastel drawings. He was recognized as one of the best etchers in this country because of his work in dry-point and aquatint etchings. He was a wood carver, and was also skilled in metal working. The last few years he became much interested in encaustic mosaic as a material for general art work; and left behind at the University work in this material represented by mosaic portraits and landscapes. His work in oil is represented by several portraits in the University Library, and by mural paintings in the old University of Illinois Library and the Auditorium,[1] the Champaign (Illinois) High School, the Sangamon County (Illinois) Court House the Colonial Theatre of Boston, the Englewood High School of Chicago, and ten historical paintings in the Cayoyo Hotel, Memphis, Tennessee. He wrote numerous articles for the popular and for the professional press. He was an authority on color, his best work being "Psychology of Color". He became Professor of Architectural Decoration, Emeritus, in 1919, and died in Algiers on January 16, 1923.

Rexford Newcomb (B.S., 1911, and M.Arch., 1918, University of Illinois; M.A. 1915, University of Southern California) taught architecture in Long Beach, California, from 1912 to 1917; in the University of Southern California during

1 The mural in the Auditorium was later removed while remodeling the building in the effort to improve its acoustical properties.

1916-17; and in the Agricultural and Mechanical College of Texas during 1917-18. He became Assistant Professor of Architecture at the University of Illinois in 1918, Assistant Professor of Architectural History in 1919, and Professor of Architectural History here in 1921. In 1931, when the Department of Architecture was transferred from the College of Engineering to form one of the units in the newly-created College of Fine and Applied Arts, Professor Newcomb became Dean of that College, and has retained that position to date.

Professor Newcomb is the author of several books relating to architecture, some of which are the following: "Franciscan Mission Architecture of Alta California", "Old Mission Churches and Historic Houses of California", "The Spanish House for America", "Mediterranean Domestic Architecture in the United States", "In the Lincoln Country", and "Outlines of the History of Architecture". He is co-author with W. A. Foster of a book entitled "Home Architecture". Professor Newcomb is also author of one bulletin issued by the Engineering Experiment Station, and in addition, is author of several books which he wrote after he was transferred from the College of Engineering, but which are not listed here.

Professor Newcomb served as Architectural Editor of Western Architect, Chicago, during 1923-30 and Editor-in-Chief during 1930-31.

His work in the field of his chosen profession has brought much credit to himself, his department, and the University.

Lemuel Cross Dillanback - (A.B., 1913, and M.A. 1914, Carnegie Institute of Technology) became Instructor in Architecture in 1915, Assistant Professor of Architectural Design in 1920, Associate Professor in 1923, and Professor of Architectural Design in 1927. He resigned in the summer of 1930 to take a position in Columbia University. Professor Dillanbach was a hard taskmaster, but he was gratifyingly rewarded for his efforts; for his students fared remarkably well at the hands of judges appointed to appraise and award architectural compositions in national and international competitive assignmentments.

Cyrus Edmund Palmer - (B.S., in A.E., 1912, University of Illinois; M.S. 1916, Pennsylvania State College) became Instructor in Architectural Engineering

at the University of Illinois in 1916, Associate in 1918, Assistant Professor in 1919, Associate Professor in 1925, and Professor of Architectural Engineering in 1929. When the Department of Architecture was transferred to the College of Fine and Applied Arts in 1931, Professor Palmer became Assistant Dean of the new College. He was made Associate Dean in 1941, and has remained with the University to date (1945).

Arthur Francis Deam (B.Arch., 1921, Ohio State University; B.Arch., 1923 Columbia University) in addition to his two years of experience in teaching at Armour Institute of Technology, gained wide training in practice before joining the University here in September, 1930, as Professor of Architectural Design. He was transferred with the Department of Architecture to the College of Fine and Applied Arts in 1931, remaining in charge of the courses in Architectural Design, where his students have been successful in winning more than a proportional share of honors in the national competitions.

c. Associate Professors

Nathaniel Cortlandt Curtis (Ph.B., 1900, University of North Carolina; B.S., 1904, Columbia University) served as teacher from 1904 to 1917, being Head of the School of Architecture at Tulane University during 1912-17. Professor Curtis joined the staff of the University of Illinois in 1917 as Associate Professor of Architectural Design. He resigned, however, in September, 1920.

Chester Morton Davison (B.S., 1898, University of Illinois) was engaged in further study and in practice until he joined the College staff in 1904. He withdrew, however, in 1905. He was employed in architectural practice again during the years following until he rejoined the University faculty in 1920 as Associate Professor of Architectural Design. He withdrew finally in August, 1923.

William Macy Stanton (B.S., 1913, and M.S., 1914, University of Pennsylvania) came to the University of Illinois in 1914, as Assistant in Architecture. He was made Instructor in 1915, but resigned in 1917 to return to his alma mater. He joined the College staff again in 1920, as Assistant Professor of Architecture. He was made Associate Professor of Architectural Design in 1921, but resigned in 1922.

Newlin Dolby Morgan (B.S. in C.E., 1910, and C.E., 1925, University of Colorado; M.S., 1928, University of Illinois) was employed in engineering practice after graduation until 1924, when he joined the College staff here as Associate in Architectural Engineering. He was made Assistant Professor in 1925 and Associate Professor in 1929. He was transferred with the Department of Architecture to the College of Fine and Applied Arts in 1931, and became Professor of Architectural Engineering in 1935. Professor Morgan is co-author with Hardy Cross of a textbook entitled "Continuous Frames of Reinforced Concrete".

Thomas Edward O'Donnell (B.S., 1913, M.S., 1924, and M.Arch., 1925, University of Illinois) was employed in architectural practice until 1917, when he joined the College faculty as Instructor in Architecture. He was made Associate in 1919, Assistant Professor in 1923, and Associate Professor in 1930. When the Department was transferred to the College of Fine and Applied Arts in 1931, Professor O'Donnell became a member of the new college, and has continued there with the University to date (1945).

d. Assistant Professors

Cyrus Daniel McLane (B.S., 1892, University of Illinois) served as Assistant in Mathematics here during 1891-93 and as Instructor in General Engineering Drawing during 1893-94. He was made Instructor in Architecture in 1894, and Assistant Professor of Architectural Construction in 1895. He remained with the University until 1904, when he resigned to engage in the private practice of architecture.

Seth Justin Temple (Ph.B., 1892, Columbia University) spent several years in study and practice after graduation, and then in 1896, joined the staff at the University of Illinois as Instructor in Architecture. He was made Assistant Professor in 1897, and retained that position until 1904, when he withdrew to engage in independent practice of architecture.

John Watros Case (B.S., 1888, Massachusetts Institute of Technology) studied abroad for a number of years, then was engaged in architectural practice until he joined the staff at the University of Illinois in 1905, as Assistant Professor of Architectural Design. He remained in that position until 1910, when he resigned to take up independent architectural practice in Detroit, Michigan.

David Varon, after studying for some time in Beaux Arts, Paris, spent the years 1903-07 in architectural practice in this country and abroad, 1907-09 as Professor of Architectural Design at Syracuse University, 1909-10 in private teaching, and 1910-12 as Assistant Professor of Architectural Design at the University of Illinois. He resigned to engage in private practice.

Percy Ash (B.S. in C.E., 1886, and C.E., 1886, University of Pennsylvania) became Assistant Professor of Architectural Design at the University of Illinois

in 1913, and remained with the University until September 1918, when he resigned. He died in Fryeburg, Maine, on June 19, 1933.

Charles Richard Clark (B.S., 1898, and M.Arch., 1914, University of Illinois) was engaged in secondary-school work and in architectural practice from 1898 to 1904, after which he came to the University to become Instructor in Architectural Construction. He was made Associate in 1906, and Assistant Professor in 1915. He withdrew in 1919 to take up private practice in architecture.

Robert Taylor Jones (B.S., 1912, University of Illinois) became Instructor in Architecture at the University here in September 1912, Associate in 1915, and Assistant Professor in 1919. He resigned in 1920.

Donald Maheny Allison (A.B., 1911, Carnegie Institute of Technology) had a teaching fellowship at Carnegie Institute of Technology during 1910-12. He served as editor for publications at the International Correspondence Schools during 1916-17, after which he became Associate in Architectural Design at the University of Illinois. He was made Assistant Professor in 1919, but resigned at the end of that school year.

Joseph Edwin Burgess (B.P., 1914, Syracuse University) became Instructor in Freehand Drawing at the University of Illinois in 1916 after two years' experience in commercial work. He was made Associate in 1919 and Assistant Professor in 1921. He withdrew from the University in September, 1922.

Norris Ingersoll Crandall (B.Arch., 1914, and M.Arch., 1915, Cornell University) joined the College staff in 1921 as Assistant Professor of Architectural Design, but resigned in August 1922.

William Caldwell Titcomb (A.B., 1904 and S.B., 1907, Harvard University) served as Assistant Professor of Architecture at the University of Illinois during 1913-17, after which he left to engage in reconstruction work in France. He rejoined the staff at Illinois in 1921 as Assistant Professor of Architectural Design, but resigned in September, 1925, to accept an appointment at the University of Michigan.

La Force Bailey (B.S., 1915, and M.S., 1916, University of Illinois; B.P.

1920, University of Kansas) was a teacher in the University of Kansas from 1916 to 1922. He then joined the University staff here as Assistant Professor of Architectural Design. He remained with the College until 1931, when he was transferred with the Department of Architecture to the College of Fine and Applied Arts, being made Associate Professor of Architecture in 1931 and Professor of Art in 1941.

William Arthur Foster (B.S. in Education, 1914, B.Arch., 1915, and A.E., 1923, Ohio State University) taught at Iowa State College and at Ohio State and for a time served as Head of the Department of Architectural Engineering at Georgia State College of Agriculture. He came to the University of Illinois in September, 1924, as Assistant Professor of Architecture -- a new position intended to render service to rural communities along architectural lines. In this connection, he gave one-half of his time to Architecture and the other half to Farm Mechanics. He was transferred to the College of Fine and Applied Arts in 1931, and was made Associate Professor of Rural Architecture in 1935. Professor Foster was author of a textbook entitled "Farm Buildings", and of another "Home Architecture". He remained with the University until his death on April 12, 1941, at Urbana.

Frank Mills Lescher (B.S., 1911, University of Illinois) was engaged in architectural practice after graduation until he joined the College staff in September, 1923, as Instructor in Architecture. He became Associate in 1928, and Assistant Professor in 1930. He was transferred in 1931 with the Department of Architecture to the College of Fine and Applied Arts, and was made Associate Professor of Architecture in 1937 and Professor in 1941.

Olaf Stavsing Fjelde (B.S., 1924, University of Minnesota; A.M., 1935, University of Illinois) became Associate in Architecture at the University of Illinois in 1928 and Assistant Professor in 1930. Professor Fjelde was transferred with the Department of Architecture to the College of Fine and Applied Arts in 1931.

c. Associates

William Mathews Hekking (B.P., 1908, Syracuse University) studied abroad in

Beaux Arts and other schools, and in 1915 became Associate in Freehand Drawing at the University of Illinois. He withdrew, however, at the end of the school year.

Rhodes Robertson (A.B., 1908, and M.Arch., 1910, Harvard University) was engaged in study and practice until he came to the University here in 1916 as Associate in Architectural Design. He resigned in September, 1918, to enter military service.

Ralph Stanlee Fanning (B.Arch., 1912, Cornell University; M.S., 1918, and M.Arch., 1921, University of Illinois) served as Instructor in Architectural Design during 1914-18, then withdrew for war work. He returned to the University in September, 1920, as Associate in Architectural Design, but withdrew finally at the end of that academic year.

Chauncey Ruthven McAnlis (B.S. in C.E., 1910, and C.E., 1915, Pennsylvania State College) joined the staff at the University of Illinois in September, 1919, as Instructor in Architectural Engineering. He was made Associate in 1921, and remained with the University until September, 1924.

Ernest Langford (B.S., 1913, Agricultural and Mechanical College of Texas; M.S., 1924, University of Illinois) first came to the University of Illinois in 1919 as Instructor in General Engineering Drawing, but was transferred to the Department of Architecture in 1920 with the title of Instructor in Architectural Construction. He became Associate in Architectural Construction in 1921, but resigned in August, 1925, to accept a position at the Agricultural and Mechanical College of Texas.

Claude Allan Patterson (B.A., 1915, University of Iowa; A.M., 1919, Harvard University) came to the University of Illinois in September, 1922, as Associate in Freehand Drawing. He remained here until September, 1925.

George Fred Keck (B.S., 1920, University of Illinois) became Associate in Architecture here in September, 1923, and remained with the College only during that academic year.

Otto Marensius Olsen (A.B., 1922, Carnegie Institute of Technology) served for a time in architectural practice, then joined the staff at the University

here in September, 1925, as Associate in Architecture. He withdrew at the end of that school year.

Daniel Donald McGervey (A.B., 1923, Carnegie Institute of Technology) joined the College staff in 1926, as Associate in Architecture, and retained the position only during that college year.

John Anthony Hartell (B.Arch., 1925, Cornell University) took graduate work in the Royal Academy of Fine Arts in Stockholm, and became Associate in Architecture at the University of Illinois in September, 1926. He remained with the Department until September, 1930.

f. Instructors

James Belangee[1], M.S., was a teacher of Architecture and Mechanical Drawing in the University of Illinois from October, 1869, to June, 1871.

Harold M. Hanson was Instructor in Architecture and Freehand Drawing at the University here from September, 1871, to September, 1872. Previous to coming here, Mr. Hanson had spent two years in study at the Bau-Academie at Berlin.

Joseph Corson Llewellyn (B.S., 1877, and M.S., 1895, University of Illinois) became Instructor in Architecture here immediately after graduation. He remained until 1879, when he became engaged as Superintendent of Building Construction in St. Louis, continuing there until 1881. He was then made Superintendent of the Lindell Railway Company, but withdrew from that organization in 1886, and later began the practice of architecture in Chicago. In 1913, Mr. Llewellyn established the Llewellyn prize in architecture here, but discontinued it after four years of uncertainties of war and industry.

Nelson Strong Spencer (B.S., 1882, University of Illinois) served as Instructor in Architecture here during 1880-83. He resigned to engage in architectural practice, but returned to the University in 1898 to become Superintendent of Buildings and Grounds. He left the University after four years of service in this connection to take up architectural practice again.

George Washington Parker served as Foreman of the Carpenter Shop in 1882 and as Instructor in Woodwork in the Department of Architecture from 1883 to 1895.

John Christopher Gustafson (B.S. in A.E., 1905, and M.Arch., 1906,

University of Illinois) was Instructor in Architecture during 1906-07, then resigned to take up commercial work.

John Terrill Vawter, Jr. (B.S., 1904, University of Illinois) served as Instructor at the University here during 1907-08, after which he resigned to engage in architectural practice.

Charles Fabens Kelley (A.B., 1906, Harvard University) was Instructor in Art and Architecture here during 1908-09.

Rudolph Weaver, after studying architecture in Drexel Institute and Columbia University, was employed in Architectural practice during 1907-09. He then served as Instructor in Architecture at the University of Illinois during 1909-11 after which he resigned to accept a position as Professor of Architecture and as Supervising Architect at the State College of Washington.

Robert James Love (B.S., 1908, University of Illinois) served as Instructor in Architecture at the University here from February to June, 1910.

Roy Childs Jones (B.S., 1908, and A.M., 1914, University of Pennsylvania) spent two years in practice after graduation before coming to the University here as Instructor in Architecture. He resigned in July, 1913, to become connected with the University of Minnesota.

Angelo Benedetto Marino Corrubia (B.S.1911, Washington University; S.M. 1913, Massachusetts Institute of Technology) joined the College staff here in 1911 as Instructor in Architecture and remained here until 1915, when he withdrew to engage in architectural practice in St.Louis. He remained in St.Louis until his death on September 9, 1943.

Roger Milton Dickhut (B.S. 1906, University of Pennsylvania) was employed in architectural practice from 1906 to 1911. He joined the faculty here in 1911 as Instructor in Architectural Design, but withdrew at the end of the academic year to return to architectural practice.

Lee Wallace (B.P., 1905, Syracuse University) served as Instructor at his alma mater during 1907-11 and as Instructor at the University of Illinois from September, 1911, until his death on September 16, 1912.

Samuel Chatwood Burton(A.C.T.C., 1904, Blackburn College, England; A.M.,1909

Royal College of Art, London) spent several years in teaching and study in England and on the Continent. He joined the staff at the University of Illinois in 1912 as Instructor in Architecture and remained here until 1915, when he withdrew to accept an appointment at the University of Minnesota.

Frederick Kitson Cowley, after several years of study at the University of Michigan and the Art Institute of Chicago, came to the University of Illinois in 1912, as Instructor in Freehand Drawing. He remained here until 1914, when he withdrew to take a position at the University of Minnesota.

Joseph Mitchell Kellog (B.Arch., 1909, and M.Arch., 1912, Cornell University) became Instructor in Architectural Design at the University of Illinois in 1912, and remained with the Department until 1916, when he withdrew to enter independent practice.

Sidney Fiske Kimball (A.B., 1909, and M.Arch., 1912, Harvard University; Ph.D., 1915, University of Michigan) served as Instructor in Architecture at the University of Illinois during 1912-13, after which he accepted an appointment at the University of Michigan.

Allen Holmes Kimball (B.S., 1910, University of California; M.S., 1912, Massachusetts Institute of Technology) became Instructor in Architectural Design at the University of Illinois in 1912, and remained here until 1914, when he withdrew to become Professor of Architectural Engineering and Head of the Department at Iowa State College.

James Hutchinson Forsythe (B.S., 1908, University of Pennsylvania; M.Arch., 1913, Harvard University) was engaged in practice during 1908-09 and served as Instructor in Architecture at Washington University during 1909-10. He joined the staff at the University of Illinois in 1913 as Instructor in Architecture and remained here until the end of the school year, when he accepted a position at the University of Minnesota.

William Sidney Wolfe (B.S. in A.E., 1913, and M.S., 1914, University of Illinois) served as Instructor in Architectural Engineering here from 1914 to 1918, when he withdrew to accept a civilian position in war service. He later became engaged in architectural practice in Detroit, where he remained until his

death on February 17, 1944. He was author of a textbook entitled "Graphical Analysis".

William Dewey Foster (B.S., 1911, and M.S., 1913, Massachusetts Institute of Technology) was engaged for a short time in practice following graduation, then joined the staff at the University of Illinois in 1914, as Instructor in Architectural Design. He withdrew, however, at the end of the academic year to take up journalistic work.

Carl Victor Burger (B.Arch., 1912, Cornell University) served as Instructor in Freehand Drawing at the University of Illinois from 1915 to 1917, after which he resigned to enter military service.

Ralph Edward Muehlman following several years of study in a number of schools including Harvard University, joined the College staff here in February, 1914, as Assistant in Architectural Design. He was made Instructor in 1916, but withdrew at the end of the school year to enter private practice.

Owen James Trainor Southwell (B. Arch., 1915, Carnegie Institute of Technology) became Instructor in Architectural Design at the University of Illinois in 1916, but withdrew in April, 1918, to enter military service.

Arnold George Scheele (A.B., 1910, and A.M., 1911, Oberlin College) after further study and some years in practice, became Instructor in Freehand Drawing at the University of Illinois in 1917, but resigned at the end of the school year to go to Michigan Agricultural College.

James Troy Peterkin (B.S., 1914, Columbia University) spent some years as a teacher and then joined the faculty at the University of Illinois in 1917, as Instructor in Freehand Drawing. He remained here, however, only a year after which he accepted an appointment at the University of Minnesota.

William Franklin McCaughey, Jr. (B.A., 1916, Carnegie Institute of Technology; M.S., 1931, University of Illinois) spent a year in practice, then joined the Department staff in December, 1917, as Instructor in Architectural Design. He resigned in September, 1920.

Wallace Bright Livesay (B.S., 1907, and C.E., 1910, Virginia Polytechnic Institute; B.S. in A.E., 1914, University of Illinois) was employed in

engineering practice until 1918, when he joined the staff at the University of Illinois as Instructor in Architectural Engineering. He remained here only until the end of the school year, however, when he withdrew to enter commercial work.

Charles Leonard Morgan (B.S., in A.E., 1914, University of Illinois) practiced as an architect in Chicago until 1918, when he came to the University as Instructor in Architectural Drawing. He remained here only during one school year; but, in addition to his teaching duties, Mr. Morgan painted an excellent bird's eye view of the College of Engineering campus. He withdrew to return to private practice.

Louise Marie Woodroofe (B.P., 1919, Syracuse University) came to the University of Illinois in 1919 as Instructor in Freehand Drawing. She resigned in April, 1926, but joined the staff again in September, 1930, as Instructor in Architecture. She was transferred with the Department to the College of Fine and Applied Arts in 1931.

Stanley Potter Stewart (B.Arch., 1920, Carnegie Institute of Technology) became Instructor in Architectural Design at the University of Illinois in September, 1920. He resigned in June, 1922, to engage in architectural practice.

Prentice Van Walbeck Duell (A.B., 1916, University of California; A.M.,1917, University of Arizona) became Instructor in Architectural History at the University of Illinois in 1921. He remained here, however, only one school year.

Edgar Greer Shelton (B.S., 1921, University of Texas) practiced a year, then joined the College staff here in September, 1922, as Instructor in Architecture. He withdrew, however, at the end of the academic year.

Ernest Pickering (B.S. in A.E., 1919, University of Kansas; B.S. in Arch., 1920, and M.Arch., 1926, University of Illinois) came to the University in October, 1922, as Instructor in Architectural Design. He withdrew in September, 1925, to accept a position at the University of Cincinnati.

Clarence Andrew Kissinger (B.S., 1923, University of Illinois) became Instructor in Architecture in September, 1923, but remained only during the school year.

Alberta Raffl (B.S., 1923, University of Illinois) became Instructor in

Architectural Design in September, 1924, but remained with the Department only during the one school year.

James Howard Chance (B.S., 1923, University of Illinois) became Instructor om Architecture here in September, 1924. He retained this position until June, 1927, when he resigned to engage in architectural practice.

Rodney Eugene Spangler (B.S., 1921, University of Illinois) became Instructor in Architecture in September, 1925, and remained in that position until 1929.

Gerald Vivian Davis after several years of study in Switzerland and France, became Instructor in Freehand Drawing at the University of Illinois in January, 1926. He resigned in June, 1928.

John William Kennedy (A.B., 1925, Carnegie Institute of Technology) joined the staff at the University here in September, 1926, as Instructor in Freehand Drawing. He was transferred with the Department of Architecture to the College of Fine and Applied Arts in 1931, becoming Associate in 1932 and Assistant Professor in 1940.

Philmore Jacobson (B.S. 1925, Armour Institute of Technology) served as Assistant in Architecture during 1925-26 and as Instructor during 1926-27.

Elmer Isaac Love (B.A., 1926, Carnegie Institute of Technology) came to the University of Illinois in 1927 as Instructor in Architecture, and was transferred with the Department of Architecture to the College of Fine and Applied Arts in 1931, at which time he became Assistant Professor of Architecture.

Ira Douglas Beals (B.S., 1927, and M.Arch. 1928, Massachusetts Institute of Technology) served as Instructor in Architecture at the University of Illinois during the academic year 1928-29.

Keith Graham Reeve (B.S. 1925, and M.Arch., 1928, University of Illinois) became Assistant in Architecture in September, 1925, and Instructor in 1928. He withdrew in 1929.

James Denton Hogan (A.B., 1925, Carnegie Institute of Technology) studied for a time in Beaux Arts, then joined the College staff here in February, 1929,

as Instructor in Architecture. He was transferred with the Department to the College of Fine and Applied Arts in 1931, becoming Associate in 1934 and Assistant Professor in 1940.

Granville Spear Keith (B.S., 1927, and M.S., 1930, University of Illinois) became Assistant in Architecture in 1927 and Instructor in 1929. He was transferred with the Department to the College of Fine and Applied Arts in 1931. He was made Associate in 1931, and Assistant Professor in 1941.

William Hune Scheick (B.Arch., 1928, Carnegie Institute of Technology) came to the University of Illinois in 1930 as Instructor in Architecture. He was transferred with the Department of Architecture to the College of Fine and Applied Arts in 1931. He was made Associate in 1931, Assistant Professor in 1932, and Associate Professor in 1941.

John Elno Sweet (B.S., 1927, University of Illinois) became Instructor in Architecture here in 1930, and was transferred to the College of Fine and Applied Arts in 1931. He was made Associate in 1935, and Assistant Professor in 1941.

CHAPTER X

THE DEPARTMENT OF MINING AND METALLURGICAL ENGINEERING

A. ORGANIZATION

General - Like the other three divisions provided for in the Polytechnic Department referred to in the report of the Regent and the four Trustees, the Catalogue and Circular of 1867-68 contained courses of study given in other educational institutions, but did not list any as arranged for the University here. While the Catalogue of 1870-71 did not include any mention of an instructional staff assigned to mining, it did state that "This Department embraces two branches of studies: 1st. Engineering operations; including mine surveys, the opening and working of mines, all mining constructions, etc., taught at present in the College of Engineering. 2nd. The subjects of Mineralogy, Metallurgy, Assaying, treatment of ores, smelting, etc., as taught in the College of Chemistry."[1] Farther on, the same issue stated: "The course for Mining Engineers differs from that of the Civil Engineering, only in the substitution of Mine Surveys and Constructions, Metallurgy, and Assaying for Roads and Railroads, Topographical and Geodetic Surveying, and stone cutting."[2] For a number of years, the engineering subjects listed under the School of Mining Engineering were taught by instructors from other departments within the College, and the Department did not become a well-established independent unit until 1885 when Theodore B. Comstock was appointed Professor of Mining Engineering and Physics.

B. OBJECTIVES AND METHODS OF INSTRUCTION

General - In general, it may be said that instruction in mining engineering deals with problems involved in the excavation and extraction, and the analysis and preparation of minerals that lie beneath the surface of the earth, while that in metallurgy relates to the analytical study of metals and the processes involved in the production of iron, steel and other alloys.

As stated specifically in the 1872-73 issue of the University Catalogue and Circular, the object of the School of Mining Engineering was summarized as follows:

1 Page 31
2 Page 42

"This School is intended to qualify the student for undertaking mining operations of all kinds. Its instruction consists of a thorough training in the principles of theoretical and applied chemistry, of chemical and blowpipe analysis, of assaying and metallurgy, and of the engineering operations of mining".[1]

The University Catalogue and Circular of 1884-85 carried the following statement:[2]

SCHOOL OF MINING ENGINEERING
OBJECT OF THE SCHOOL

"This school has been established to meet the growing demand for a very important industry for thoroughly trained engineers, fitted to solve the numerous perplexing problems which are constantly arising in all mining work. The subjects of the discovery, opening, economical working and proper ventilation of mines, the prevention of accidents, transportation above and below ground, treatment of products, with many others which fall within the scope of the mining engineer, can be mastered only by a careful study of facts and principles. This is the proper foundation for the practical work of the profession, and it is the aim of this school to present this in the most complete and thorough manner.

INSTRUCTION

"It is important that a broad basis be laid by way of general preparation, for the more technical studies here included. Whatever of general culture the student may obtain before entering the University, will not come amiss, and, although the requirement is not made, it is advised that all who can do so, should acquire a reading knowledge of French or German before beginning this course.

"This course comprises the greater part of the pure and applied mathematics of the courses in mechanical and civil engineering. Much time is devoted to chemistry and geology, with the addition of technical studies peculiar to mining engineering and metallurgy.

"Students who are graduates from this school are not supposed to be familiar with all the details of mining management from actual experience, but they will have obtained such a knowledge of the principles underlying all successful practice, and such familiarity with the science of mining in all its branches that the art may be acquired with the minimum of practice.

"Lectures are given where desirable, but these are to be regarded as supplementary to other modes of instruction, which are made to conform as closely as possible to the routine of the engineer in practice. In every detail the student is made to feel that he is dealing with the actual problems which he will meet in his professional work.

"Plans, estimates, drawings, and calculations, based upon data obtained in the student's own experience, are constantly required, and no pains are spared to familiarize each member of the class with the duties and responsibilities of every grade, from miner to manager.

COURSE OF STUDIES

"In the first two years the work is similar to that required in the course in Civil Engineering, but more time is given to chemistry. In the third year,

1. Page 32
2. Page 44

geology and mining engineering, with assaying and metallurgy,[1] take the places of special technical studies in the other engineering courses. In the fourth year, with the exception of two terms in Prime Movers taken with the students in mechanical engineering and some studies of general character, the work is strictly technical".

Temporary Provision for Instruction in Mining - Professor Robinson, Head of Mechanical Engineering, continued to lecture on mining topics until his resignation in 1878. During 1882-83, Regent Peabody lectured on mining subjects to the two or three students who were registered in the course. Some subjects were, of course, offered by the Department of Chemistry, but no other work was presented in this particular field until Professor Comstock took charge in 1885.

Apparatus for the Lecture Room - The catalogue of 1878-79[2] stated that lectures in mining engineering were "illustrated by a valuable series of models, obtained from Freiburg, at a cost of $2,000 illustrating sections of mines, machinery for elevating and breaking ores, with furnaces and machinery for metallurgical processes".

Early Laboratory Equipment - In regard to the progress made in providing laboratory equipment, the Catalogue and Circular of 1887-88[3] contained the following statement: "An extensive mining and metallurgical laboratory is in process of arrangement. A considerable portion of the machinery is already in working condition".

The Catalogue and Circular of 1890-91[4] described the equipment somewhat in detail as follows:

"The department has a valuable collection of mining and metallurgical machinery.

"The newly-equipped laboratory (located in the Chemistry Building) now contains a very complete line of illustrative machinery, designed for practical use, and covering a wide range of metallurgical processes. The machines are operated by steam power, and include apparatus for crushing, screening, washing, concentrating leaching, precipitating, and many other methods of ore treatment of the latest modern types.

"In the manipulation of these machines, and the tests made on a working scale, the student is afforded opportunity for practice illustrative of the classroom work. The plant consists of a Dodge ore-crusher, a pair of Cornish rolls, elevator with deflecting spouts, automatic sampler, revolving screen, separators, rotating table, jigs, etc.; chlorine generator, tanks, vats, and troughs, gas and blast furnace, with suitable appliances so arranged that they may be used together or separately as occasion may require".

1. These subjects were given by the Department of Chemistry.
2. Page 21
3. " 29
4. Pages 41-42

C. THE DEPARTMENT DISCONTINUED AND RE-ESTABLISHED

The Department of Mining Engineering Discontinued- As the curriculum in Mining Engineering was much less complete in those early days than the three other engineering curricula, and as there was no one who took more than an incidental interest in the work, it did not attract much attention from the students. During the first ten years, there were usually one or two mining students registered in the course of study, but never more than six.

The Department was not really organized until 1885. At that time, there came a considerable demand from among interests of the State for recognition in the curriculum of the University; and in response to this demand a professor was appointed and a Department of Mining Engineering, the equal of the other engineering departments, was organized at considerable expense. After a trial of four years without any considerable application of this course by students, the Department was allowed to lapse.

After lying dormant for two years, it was resuscitated and a course for the benefit of the coal miners was developed. This effort met no better response, however, and the Department was abolished in 1893 with no thought that it ever would be re-established, for "the business agent and Professor Breckenridge were given authority to dispose of the machinery, now in the basement of the Chemical Laboratory, provided they could do so on terms deemed satisfactory".[1]

The Department of Mining Engineering Re-established by Legislative Action - In spite of the earlier experience abolishing the Department in 1893 because of an apparent lack of interest, a very substantial movement had gained considerable headway by 1908 to re-establish the Department here. For one thing, the Braidwood disaster had served as a vital stimulus in reviving mining education and in revising the laws pertaining to the inspection and regulation of mines. Other factors were having their influence too, so that by 1908 the mining interests of the State were showing a new spirit and were urging the reestablishment of the work at the University.

Dean Goss took a deep interest in the reestablishment of mining engineering

1 Report of Trustees, 1894, page 213, giving an account of the meeting of the Board on December 13, 1893.

at the University after he joined the staff here; and under date of May 26, 1908, in his first annual report as Dean of the College, made the following statement:

"Illinois stands third among the states of the union in the value of its mineral products. Its iron and steel mills make up one of the great manufacturing centers of the world. Smelters for lead, gold and silver are operated within its borders. Its coal mines alone employ 62,000 people; but there is no place in our educational system where the workers of this industry can go for guidance. There is no laboratory in the state, nor any corps of men who in a scientific way are studying the problems of the mine. Such fundamental matters as ventilation and as the use of powder are but imperfectly understood, and the problems of haulage, hoisting, screening and washing are not being especially studied by those who later on are to be responsible for the operation of the mines of the state. The College of Engineering should as soon as practicable enter this field . . . . As the mining and metallurgical activities of our state are not the same as those of other localities, so a department of mining engineering for Illinois would not be the same as existing departments of schools of other states. There is an opportunity before the University to establish along broadly scientific lines a department of mining engineering which will be unique among the institutions of our country . . . . I shall hope that the time is not far distant when a beginning can be made in the establishment of such a department".

Shortly after this, the Dean sent out letters to prominent coal operators, mining engineers, dealers, and other persons of influence in the State, explaining the proposal and asking for their opinions regarding it. In every case, the replies were heartily in favor of the plan and some were decidedly enthusiastic. Accordingly, Dean Goss included in the budget for the two years beginning on July 1, 1909, an item of $25,000 as a provision for instruction and equipment in mining engineering.

On March 11-13, 1909, the Illinois Fuel Conference was held at the University of Illinois under the auspices of the College of Engineering, the Engineering Experiment Station, and the U.S.Geological Survey. About that time, too, a movement that had been under way to establish a Mine Rescue Station (described later in this chapter) at the University that would be a cooperative enterprise of the University and the Technologic Branch (later, the U.S.Bureau of Mines) of the U.S.Geological Survey, materialized so that the date set for the opening was made to coincide with that of the Fuel Conference. During this joint meeting and conference there was developed a strong feeling favorable to the adoption of more scientific methods in the further development of the mining properties of the State. The need of trained men to plan and to supervise mining operations

and the need of a better understanding of the fundamental principles underlying the detailed operations of mines, were emphasized throughout the program. One of the results of this joint session was the adoption of a series of resolutions favoring the establishment at the University of a department of mining engineering. A committee appointed by the meeting, representing the mine operators, the United Mine Workers, State mine inspectors, and the Illinois Manufacturers' Association, was responsible later for the introduction of a bill before the General Assembly then in session, "authorizing and directing the establishment of a department of mining engineering in the College of Engineering at the University of Illinois, and providing for the support of the same". The bill passed the Assembly, and on June 8, 1909, was signed by Governor Deneen.

One provision of the Act establishing the Department states: "That in addition to offering such courses of instruction as will best train young men for efficient work in the various phases of mining industries, the department shall concern itself with the development and dissemination of scientific facts that will be of value to the mining industry and will conserve life and the resources of the State".

The Assembly of 1911 made possible a decided improvement in the work of the Department of Mining Engineering by increasing the appropriation for operating expenses and by an allowance of $25,000 for equipment, also by authorizing a co-operative investigation of coal-mining conditions in Illinois by the Department of Mining Engineering, the State Geological Survey, and the U. S. Bureau of Mines, It was hoped that a separate mining building could be obtained, but instead of the $200,000 asked for the purpose, $25,000 for equipment was given.

D. OFFICE, CLASSROOM, AND DRAFTING ROOM ACCOMMODATIONS, 1909-1945

General - Professor H. H. Stoek was appointed Head of the Department of Mining Engineering on September, 1909, but he did not assume the duties of his office until October 15, following, and did not start classes until the second semester of that academic year. A temporary office was established in the quarters of the Assistant Dean of the College of Engineering. As soon as the Physics Building was completed about December 1, 1909, the department office

was moved to Room 106, there, and recitations were held in Room 104 of that same building. Beginning with the first semester 1910-11, recitations were held in Rooms 104 and 208 Physics Building. Room 102 Engineering Hall was also used for a recitation room that semester and one of the rooms in the new Ceramics Building, now a part of the Mechanical Laboratory, was used for a drafting room. During the second semester of 1910-11, a room on the second floor of the Mathews Avenue Power Plant served as a combination recitation, drafting room, and office for one of the instructors. This room was used, too, for the beginning of a departmental library and as a meeting place for the Mining Society.

During 1911-12, the department office remained in 106 Physics Building, and three other rooms were made available there for the use of the Department. Room 202 of the Mathews Avenue Power Plant was used as an office, drafting room, and recitation room during the first semester of 1911-12. During the second semester, Rooms 104 and 109 of Engineering Hall were used -- the former as an office and drafting room and the latter as a combination recitation, drafting, and reading room.

At the beginning of the school year 1912-13, the Transportation Building was completed, and the Department gave up the rooms it formerly had in other buildings and took over Rooms 208 and 209, in this new structure for the departmental office. Room 214 was taken for a general class room and laboratory, Room 205 for a mining museum, Room 206 was fitted with a stereoptican and a chemical table for classroom use, and Room 207 for a drafting room. In addition to desks, Room 207 was supplied with a complete set of manufacturers' catalogues of mining machinery along with an index of these catalogues for student use, and an assortment of mine maps and mine structures. The instruments used in underground surveying -- mining transits, levels, etc., were also kept in this room in order that they could be used for class demonstration.

On November 11, 1914, Room 202 was taken over for a library and study room for the Railway and Mining Engineering students, most of the books having been brought over from the Main Library. These included textbooks, bound copies of

the leading railway and mining magazines, the Proceedings of the American Institute of Mining Engineers, and a good collection of State Geological Survey reports. The room was given up as a library, however, in 1918 -- the railway books and most of the mining books being sent to the Engineering Library.

The Department of Mining Engineering, which became the Department of Mining and Metallurgical Engineering in 1934, continued to occupy these quarters on the second floor of the Transportation Building until September, 1941, when it moved into the part of the space on the third floor of the Ceramics Building vacated by the State Geological Survey after it had transferred to the new Natural Resources Building on the south campus.

When the Metallurgical Building was completed in 1936, one classroom, two offices, and several rather small laboratories were available in it for the Division of Metallurgical Engineering.

The Department has always labored under somewhat of a handicap because its offices, classrooms, and laboratories have never been housed in a single building devoted entirely to this particular field. On account of that fact, it has not been able to express itself and to display its facilities to advantage for public observation and attention as most of the other departments have been able to do -- a condition that may have had some bearing on the size of the student enrollment.

E. DEVELOPMENT OF LABORATORY FACILITIES IN MINING AND METALLURGICAL ENGINEERING

General - After the Department of Mining Engineering was discontinued in 1893, no new equipment was provided for instruction in laboratory work until the Department was reestablished in 1909. Even then, no systematic effort was made to introduce laboratory work on any scale until the construction of the Mining Engineering Laboratory, because there was no appropriate space available for setting up such equipment.

Although the contract for the erection of the Mining Laboratory called for the completion of the building on July 1, 1912, the structure was not finished

until late in the fall. The machinery could not be installed in time for the first semester, but was ready for use at the beginning of the second semester.

The facilities provided for laboratory work after 1909 are described briefly in the following pages.

Mine Surveying - Shortly after the Department was located in the Transportation Building, it procured a number of instruments including mining transits, levels, and accessory apparatus for surveying both above ground and underground, the underground surveying being carried on within the heating tunnels of the campus system. The equipment was kept in one corner of Room 207 of the Transportation Building so that it could be used for demonstration purposes in connection with the classroom exercises, until 1922-23, when it was transferred to an adjacent room, 207B, formed by partitioning off the south end of the building corridor.

Sampling and Grinding Laboratory - As soon as the Mining Laboratory was opened in 1912-13, or shortly thereafter, complete field and laboratory equipment was provided for sampling and reducing samples of coal and ore. The grinding room was equipped with coal and mineral grinders and pulverizers, pebble mills, testing sieves and sieve-testing apparatus, disc-type of pulverizing mills, a jaw crusher, a mechanically-driven agate mortar, a sample mixer, and other similar apparatus.

Fuels Laboratory - When the Mining Laboratory was completed in 1912-13, one room at the south end of the building was set aside as a chemical and physical laboratory and was equipped with facilities for the analysis of coal, coke, oil, natural gas, and mine gases, and for carrying on assay work. At that time or within the next few years, there was provided complete equipment for the proximate and ultimate analysis of coal, for the determination of the coking properties of coal, and for the study of sulphur in coal, fusability of ash, and the calorific value of coal. Special apparatus includes gas furnaces, fuel calorimeters, drying ovens, sulphur turbidimeter, calorimetric pH comparator, combustion trains, and specific-gravity apparatus. The facilities have been improved from time to time as new devices and methods have been developed. A

well-equipped balance room adjoins the laboratory. In 1942-43, additional space was taken for this work when Room 151 in the southwest corner of the building was developed into a calorimetry and gas testing laboratory.

Coal-Preparation and Ore-Dressing Laboratory - Early in 1910-11, as previously stated, a portion of a small room on the first floor of the Mathews Avenue Power Plant was used for illustrating the operations of coal-washing and ore-dressing equipment. During the second semester of that school year, Room 202, in that same building was used to house the equipment. When the Mining Laboratory was finished in 1912-13, approximately half of the north end of the main room was given over to equipment devoted to work in the preparation and testing of coal. The facilities installed at that time or a few years later included coal crushers and pulverizers, shaker and vibrating screens, wet concentration tables, air tables, jigs, sand-flotation and froth-flotation facilities, a centrifugal drier, and filters. A briquetting press was put in for making coal briquettes.

The other half of the main room was occupied by machines that had a special application to ore-dressing and hydrometallurgical problems. Some of this installed at the opening of the laboratory or a few years afterwards, included gyratory and other rock crushers for the initial crushing of the ore; rolls; pebble, ball, and rod mills; hydraulic and mechanical classifiers; stamp mill with amalgamation plates; jigs; sand and slime leaching equipment for gold or other metallic ores; a magnetic separator; an electrostatic separator; and a large drying oven. Special apparatus for carrying on experimental work in amalgamation, cyanidation, electro-magnetic and electro-static testing, oil flotation, and other hydro-metallurgical commercial operations has been provided from time to time as the opportunity presented itself.

Mine-Ventilation and Safety-Lamp Laboratory - During the second semester of 1910-11, a small room on the first floor of the Mathews Avenue Power Plant was equipped with appliances for the study of mine gases and safety lamps. During 1911-12, Room 315 of the Physics Building was made into a safety-lamp laboratory

At the beginning of 1912-13, the Transportation Building was completed and Room 210 in that building was taken over for a ventilation or safety-lamp laboratory and a mine gas laboratory. This space was fitted with equipment designed for ventilating coal and metal mines -- with such appliances as safety and testing lamps, and with practically every make of safety lamp represented, for the study of mine gases. There was installed apparatus, also, for detecting various inflammable and explosive gases in mines. A dark room contained in the laboratory was equipped with an Oldham gas-testing machine. In the summer of 1913, there was added a Hailwood gas cap observation machine for safety lamps, an electric relighter for safety lamps, and other equipment. By 1917, there had been accumulated also facilities for the measurement of ventilation air currents, and the Fraser coal-dust testing apparatus as developed by the U. S. Bureau of Mines. This material was all transferred to Room 101 of the Mining Laboratory in 1917 and 1918.

This equipment has been added to from time to time as it became available in the market for instructional and experimental purposes, until in 1945, the collection of various kinds of miners' lights, dating from the primitive fire wheel to the modern types of flame safety lamps and approved electric cap lamps, is one of the most complete in the United States. A photometer, gas-analysis apparatus, and lamp-testing machines, as well as gas detectors, are available for research and instruction purposes. In addition, mine ventilation models, fans, and a duct system in which small-scale shaft and timbering conditions may be simulated and tested, comprise a very important part of the ventilation laboratory. Miscellaneous equipment consists of anemometers, sling psychrometers, katathermometers, Wahlen and Ellison gages, etc.

Drilling and Blasting Laboratory - In 1911-12, Room 401 in the Physics Building was used to house materials illustrating explosion and blasting equipment. Room 407 in that same building was used to house coal and rock drills set up for exhibition purposes, but there was no power available there for operating them. When the Mining Laboratory was finished in 1912-13, the drilling and blasting apparatus was transferred to the south end of the main room of that

building where a rock-drilling and coal-cutting table was provided. Four additional rock drills were acquired in 1924-25. A sullivan Rock-drill sharpener and shaper powered by compressed air, a gas forge for heating rock drills, and a comparascope for determining quenching points for drills, were supplied in 1925-26.

Other apparatus has been added as funds have become available from time to time until 1945 the collection of representative cutting and drilling machinery and accessories consists of coal cutters, hand and electric augurs, percussion rock drills of various types, a portable diamond drill, a gas-fired heating furnace for drill steel, and a compressed-air drill sharpener. There has been provided, also, such typical devices as dummy cartridges, squibs, fuses, electric detonators, tamping tools, blasting machines, circuit testers, shot-firing equipment, and a demonstrating model for studying the charging of drill holes.

Heat-Treatment Laboratory - Work on the development of the heat-treatment laboratory, designed to study the effects of heat-treatment on the physical properties of metals and alloys, was begun as soon as the Metallurgical Building was completed in 1936. The equipment installed then or since that time includes a number of large, medium, and small gas and electric furnaces -- some with time clock and automatic control. The gas furnaces are capable of attaining a temperature of 2,800 degrees F. and are useful in carborizing and nitriding steels. An electric arc furnace built by the Department in 1937-38, is capable of producing a temperature of 3,000 degrees F. There has also been provided adequate pyrometric equipment consisting of base and noble metal thermocouples, potientiometers, millivoltmeters, optical and radiation pyrometers, and other appropriate facilities. One side of the room is provided with a Riehle universal 40,000-pound testing machine and a universal 220 foot-pound testing machine used to examine the physical properties of heat-treated steels, and with Brinell, Vickers, and Rockwell testing machines for determining the hardness of these steels. A high-speed cutting machine, with a carborundum disc capable of rotating at extremely high speeds, has been provided to cut the finest grades of

tool steel. There has also been added a Wilson dilatometer to study the expansion of metals during the heating processes. The laboratory is supplied, in addition, with apparatus for growing single crystals of metals and alloys; with thermo-analysis devices having a speed of 0-3 000 degrees F. in one second; with liquid and metallic heat-treating baths for studying isothermal phase changes; with furnaces and facilities for investigations on the hardenability of steels; and with appliances for determination of the endurance limit of metals and alloys.

Assay Laboratory - After the Mining Laboratory was completed in 1912-13, the work in the assaying of ores was done in the departmental chemical laboratory along with such other work as fuel and mine-gas analysis. The equipment provided at that time or shortly thereafter for assaying included analytical workdesks, hand jigs, classifiers, gas muffle furnaces, gold pans, magnetic ore separators, and other auxiliary apparatus for making tests of ores and ore products.

In 1936, when the Metallurgical Laboratory Building was completed, the facilities used for assaying purposes were transferred to it from the Mining Laboratory.

The assay laboratory is now equipped with chemical desks, hoods, and the necessary apparatus to accommodate twenty students per section working on analysis of gold, silver, and other ores. A balance room located adjacently is well supplied with facilities for instructional and experimental work.

Electrometallurgical Laboratory - For small-scale experimental work, there is located on the first floor of the Metallurgical Building a large electrometallurgical laboratory that was equipped during 1937-39 with tables, hood, voltmeters, ammeters, and accessory electrical equipment, and supplied with both direct and alternating current for carrying on electroplating and other phases of electrometallurgy.

Welding Laboratory - Work was begun recently on the establishment of a welding laboratory. In a large room set aside for this purpose, have been provided a Lincoln arc welder and an oxy-acetylene welder set up in specially-

prepared booths with appropriate auxilliary apparatus.

Melting Laboratory - The melting laboratory, recently opened, contains an Ajax-Northrup high-frequency induction furnace rated at 50 pounds capacity and auxilliary appliances for fusion in vacuum. There is also a 50-pound electric-arc furnace for direct and indirect types of melting.

Metallographic Laboratory - The metallographic laboratory designed for the study of the internal or micro-structure of metals and alloys and the relation of the structure to the physical properties of metals, is located in Room 209 on the second floor of the Metallurgical Building and is one of the main features of the building. The laboratory has accommodations for twenty students per section and each man has his own equipment including a metallurgical microscope. One one side of this room is an enclosed grinding room for specimen grinding containing belt and wheel type of grinders, work benches, and equipment for the preparation and deep etching of specimens. There are a number of individual-drive polishing machines for the preparation of specimens for microscopic examination. Supplementary to the metallography laboratory is a room containing a number of cameras including both the micro type, or those for taking photographs at high magnification, and the macro type, or those for taking pictures at low magnification, for use in the study of the structure of metals in connection with either instructional or research programs. Adjacent to the camera room are a number of dark rooms for developing and printing work. Recently there was provided an X-ray diffraction unit for the study of the atomic structure of materials.[1]

F. MUSEUM MATERIALS AND COLLECTIONS

General - The Department of Mining and Metallurgical Engineering has assembled museum materials from time to time, having in 1945 a collection of models showing the methods of working coal and ore mines. It has also a complete set of safety lamps and other mine-lighting devices. It has, in addition, a complete set of explosive and blasting materials and appliances, a number of devices used in mine ventilation, and an exhibit of helmets and other mine-

1. The Technograph, February, 1936, page 7

rescue and first-aid demonstration equipment. There is available, too, a number of full-size sectionalized and working machines showing the operation of mining apparatus. Besides all of these facilities, the Department has a large collection of photographs and blueprints illustrative of mining and metallurgical practice and construction, and of specimens of ores, coal, non-metallic minerals, metallurgical products, and refractories.

G. AFFILIATED AND COOPERATIVE AGENCIES

General - In addition to its work of instruction, the Department of Mining Engineering became closely associated with the various mining activities of the State and with the Technologic Branch of the U.S. Geological Survey (later the U.S.Bureau of Mines) and the State Geological Survey in establishing Mine Service Stations and in the conduct of investigations on coal-mining problems, with the Mining Investigations Commission, and with the Illinois Miners' and Mechanics Institutes. The work of these various agencies is described briefly in the following paragraphs.

Mine Rescue Station at Urbana[1] - As previously stated, a Mine Rescue Station was established at the University on March 11, 1909, by the Technologic Branch of the U.S.Geological Survey(later the U.S.Bureau of Mines) to cooperate with the Illinois State Geological Survey and the Department of Mining Engineering of the University. While the main station at Pittsburgh devoted most of its study to problems of mine explosions -- analysis of coals and gases -- the Urbana Station, the second of its kind in the United States, was intended to concentrate upon the rescue of men overcome in mine disasters. Specifically, its work was to demonstrate to mine operators, mine inspectors, and mine workers, and others, the value of modern mine-rescue equipment, such as oxygen helmets, and resuscitation apparatus for use in connection with rescue work in mines, as an aid to fighting mine fires, and to open and examine mines which had been sealed in order to determine the cause and effects of explosions and fires.

The equipment of the Station included recent inventions as follows: four Draeger Oxygen helmets and recharging apparatus; one Draeger resuscitating case;

1 "The Mine Rescue Station at Urbana," by A.C.Yehling E.E.'09, The Technograph 1908-09, pages 122-125.

four Hubbel electric portable safety lamps; one portable Orsatt outfit for qualitative analyses of mine gases; and one "smoke room".

The oxygen helmets were made of metal, and resembled the helmets worn by deepsea divers, except that they were smaller. There was no need for their being heavy and strong because there was no pressure as in deep-sea diving.

The Hubbel portable safety lamps were made of aluminum to give as little weight as possible. The light was supplied from a small incandescent lamp lighted from current from a small storage cell.

The Orsatt outfit was a necessary apparatus for the hasty call to any mine for making analyses of mine gases. The analyses were made before any heavy reconstruction or rescue work was attempted.

The "smoke room" was a gas-tight structure 12 by 25 feet by 12 feet located in the north bay of the Mechanical Engineering Laboratory Building. The interior was fitted with heavy beams and low passageways, similar to the construction of an actual mine. Sulphur could be burned in the room, producing conditions resembling those found after actual mine disasters. A dummy of a man offered an opportunity for practice at resuscitation of victims.

The Station not only gave demonstrations, but also undertook to train men in the use of such apparatus, the service being given gratuitously, and as far as possible, to all interested within the limits of Illinois, Indiana, Michigan, Western Kentucky, Iowa, and Missouri. Several mine operators and mine bosses took advantage of the services offered by the Urbana Station to obtain training in the use of the new apparatus. During the twelve-month period following the establishment of the Station, the engineer in charge of the Station, Mr. Robert Y. Williams, was called into the field on the occasion of two explosions, seven fires, four mine examinations with the aid of the helmets, and two conference demonstrations.

The Department of Mining Engineering was especially fortunate in having the Rescue Station established at the University. It offered the students in mining engineering an unusual opportunity to study rescue work and to come in contact with men in practice from all parts of Illinois and the neighboring

states who came to the Station for training in rescue operation.

Mine Rescue Station Commission - One result of the work of the Urbana Station, aside from any material assistance given in the rescue work at the disasters visited, was that on February 17, 1910, the General Assembly enacted a law providing for a Mine Rescue Station Commission authorized to establish, equip, and operate three rescue stations. An appropriation of $75,000 was secured for instituting these stations. The Head of the Department of Mining Engineering at the University was made a member of the Commission. Shortly after the Commission was organized, the Cherry Hill (Illinois) mine disaster occurred,[1] at which Mr. R. Y. Williams, who was in charge of the Urbana Station, as previously mentioned, and Professor Stoek, distinguished themselves in working with the Commission in affording aid to the victims of the explosion and fire, using the newly-invented oxygen helmets for the first time.

The establishment of the three stations following the one at the University made Illinois the first state in the country to adopt the modern rescue apparatus and rescue methods to safeguard the lives of its citizens engaged in the coal-mining industry.

With the reorganization of the State Government in 1917-18, the work of the Mine Rescue Commission was transferred to the new Department of Mines and Minerals, and the University was relieved of any further responsibility in connection with this Commission.

Illinois Mining Investigation Commission - In 1909 the General Assembly authorized the appointment of the Illinois Mining Investigation Commission to formulate desirable legislation for the control of coal mines -- Professor H. H. Stoek, Head of the Department of Mining Engineering at the University, becoming a member of the Commission on December 3. Room 214 Transportation Building, originally assigned to the Department of Mining Engineering and fitted for a laboratory, was made into an office for the Commission. The Commission gave much time to studying the existing mining conditions in this and other states, to formulating bills to correct the most outstanding evils then prevailing in the

1 November 13, 1909

mining industry in the State, and to hearings on the bills before the General Assembly. As a result of the efforts of the Commission, the mining laws of Illinois were very substantially improved to the advantage of the mine owners as well as the mine workers.

When the State Government was reorganized in 1917-18, the work of the Mining Investigation Commission was also assigned to the newly-created Department of Mines and Minerals, and the University was relieved of any further obligation in this direction.

Illinois Miners' and Mechanics' Institutes - One of the outcomes of the Cherry Hill mine disaster, previously mentioned, was that the Illinois Miners' and Mechanics' Institutes were established by act of the General Assembly and approved on May 25, 1911, an appropriation of $30,000 being provided by the Assembly in 1913 to meet the expenses of the next two years. The purpose of the Institutes as stated in the act creating them was "to prevent accidents in mines and other industrial plants, and to conserve the resources of the State." The immediate purpose was to assist men in preparing to pass the tests required by State laws for such positions as state mine inspectors, mine managers, mine examiners and hoisting engineers, and others in keeping abreast of the times.

Such legislation seemed especially appropriate on several counts at that particular time. Many boys who were leaving the public schools at an early age to go into the mines and other industries, were later in life handicapped through lack of early training, in preparing themselves to pass the educational tests required by the State or their employers before they could occupy positions of responsibility. Furthermore, a large portion of the working class was made up of foreign elements from the agricultural districts of southern Europe who had come into the State with no previous knowledge of the technology or dangers of mining operations. As they frequently did not speak nor write the English language, some special means had to be taken to teach them, both for their own protection and for the conservation of the coal resources of the State.

The administration of the affairs of the Institutes was vested with the

Board of Trustees of the University. On January 1, 1914, the Trustees appointed as Director R. Y. Williams[1] and placed the Institutes under the general supervision of the Department of Mining Engineering of the University. Room 203 Transportation Building, was converted from a recitation room to an office for the Institutes.

Two bulletins were written to govern the policy of direction; and on April 1, 1914, instruction was begun in Herrin and Harrisburg with 138 and 136 students, respectively. These courses were followed by similar ones in Belleville and Collinsville, and a series of short courses, in weekly units, was in progress on the campus. The Institutes were abandoned on July 1, 1915, when Governor Dunne vetoed the item in the appropriation bill. At the time the Institutes were abandoned there were eighteen night schools being successfully carried on with an enrollment of over a thousand students. The plan was an excellent one and served a much-needed service to the mineral industries of Illinois. Similar plans have been made since that time, but they have never materialized, although they are very much needed. When the new Department of Mines and Minerals was created in 1917, there were no steps taken towards continuing the activities of the Institutes and therefore the work came to an untimely end.

Cooperative Investigations of Illinois Coal Problems - In July, 1911, a co-operative investigation authorized by the Forty-seventh General Assembly, for two years, was begun by the Department of Mining Engineering at the University, the State Geological Survey, and the Technologic Branch of the U. S. Geological Survey(later the U. S. Bureau of Mines) to determine the means for enabling the operators and miners in Illinois to produce coal more safely, more cheaply, and with less waste. In a special laboratory established by this group in the quarters of the Department of Mining Engineering at the University, samples of coal from more than a hundred mines were analyzed and studied for conditions pertaining to

1 Robert Young Williams (A.B., 1901, Princeton University; E.M., 1904, Columbia University) was engaged in engineering practice in coal-mining work in Pennsylvania and West Virginia until he was placed in charge of the Mine Rescue Station at Urbana, in 1910. In 1914, Mr. Williams was made Director of the Illinois Miners' and Mechanics' Institutes, but when these were discontinued in 1915, he returned to practice in Pennsylvania.

friability, explosibility, ventilation, storage, washability, chemistry, methods of mining, and so on. The authority was renewed from time to time; and although the U. S. Bureau of Mines withdrew from the cooperative agreement on January 1, 1926, when it left the University campus, the cooperative work between the State Geological Survey and the Department of Mining Engineering was continued. Over 50 bulletins were published giving the results of the investigations, and these have been of great benefit to the mining interests of the State in matters relating to the mining, preparation, storage, and utilization of coal.

Illinois Mining Institute and Mining Scholarships - The history of the Department of Mining and Metallurgical Engineering has been closely associated with the history of the Illinois Mining Institute, the two organizations having grown up with mutual interests. Two members of the departmental staff have been presidents of the Institute, Professor H. H. Stoek, 1921-22, and Professor A. C. Callen, 1929-30. An expression of their interest of the Institute in the Department of Mining and Metallurgical Engineering was symbolized in the establishment of four scholarships in mining engineering at the University in 1941. These scholarships are known as the Illinois Mining Institute Scholarships in Mining Engineering. In addition to the above scholarships, the Institute has been instrumental in securing eight additional scholarships known as the Peabody Coal Company Scholarships in Mining Engineering. These scholarships became effective with the 1942-43 school year and are administered by the Illinois Institute Committee on Scholarships.

H. FACULTY PERSONNEL

General - Brief biographical sketches of faculty members above the grade of assistant that have been connected with the Department of Mining and Metallurgical Engineering, are listed in the next few pages in chronological order according to rank.

a. Heads of the Department

General - Stillman Williams Robinson served as Instructor in Mining Engineering from 1871 until 1878, teaching "Mining Operations". Regent Peabody lectured on mining subjects during 1882-83 to the two or three students who were

registered in the curriculum. Theodore B. Comstock was in charge from 1885 until 1889. No one seemed to be in charge from 1889 to 1891, but at that latter date, William John Baldwin became Head of the Department and served until 1893, when the Department was discontinued in the belief that students were not interested in these subjects, for in the twenty-three years of the life of the Department, the high tide of attendance was only seven students. The Department was re-established, however, in 1909 with Harry Harkness Stoek as Head. Professor Stoek remained in office until 1923, after which Alfred Copeland Callen became Head and served until 1939. Harold Leroy Walker followed as Head and has continued in that capacity to date. Biographical sketches of these men follow.

Stillman Williams Robinson - Professor Robinson's biographical sketch was given under Mechanical Engineering and is not repeated here.

Theodore B. Comstock was born at Cuyahoga Falls, Ohio, on July 27, 1849. He received the A.B. degree from Pennsylvania State College in 1868, the B.S. degree from Cornell University in 1870, and the D.S. degree there in 1886. He served as Professor of Geology in Cornell from 1875 to 1879, and was engaged in engineering practice from 1879 until he joined the faculty of the University of Illinois in September, 1885, as Professor of Mining Engineering and Physics. Because he had had a varied experience in teaching and practicing his profession as geologist and mining engineer, it was believed that he would rapidly develop the languishing curriculum in mining engineering. He offered a complete and well-planned four-year curriculum in Mining Engineering; and considering its financial condition at that time, the University was liberal in supplying equipment. It seemed impossible, however, to develop any interest on the part of the students; and Professor Comstock resigned in 1889 to engage in engineering practice again, and passed away on July 25, 1915, at Los Angeles, California.

Walter John Baldwin was born at West Bradford, Pennsylvania, on March 12, 1864. He received the B.S.degree from the University of Michigan in 1890 and the E.M. degree there in 1894. Professor Baldwin served as a teacher in the Michigan College of Mines before he joined the faculty of the University of Illinois in

1891 as Professor of Mining Engineering. He tried to instill new life into the dormant department, but gave it up and resigned in 1893 to enter practice. He passed away on April 8, 1924.

Harry Harkness Stoek was born in Washington, D.C., on January 16, 1866. He received the B.S. degree in Mining Engineering at Lehigh University in 1887, and the E.M. degree there in 1888. After having been engaged in mining practice during 1888-90, Mr. Stoek then served as Instructor at Lehigh University during 1890-93, as Assistant Professor of Mining and Metallurgy at Pennsylvania State College during 1893-98, and as Editor of "Mines and Minerals," at Scranton, Pennsylvania, during 1898-09. He then came to the University of Illinois on October 15, 1909, as Professor of Mining Engineering in charge of the reestablished department. Because it was too late to offer any instructional work during the first semester of that year, Professor Stoek spent his first months in planning courses for the curriculum in mining engineering, and in acquainting himself with the mining conditions throughout the State by attending meetings of the Illinois Coal Operators' Association, the United Mine Workers, the State Mining Board, and other similar organizations. During the second semester of his first year, 1909-10, he gave instruction to three sophomores, students in mining, and to one in mechanical engineering and one in civil engineering taking courses in his department. As the students came along in after years, the whole curriculum went into effect under his direction.

Shortly after coming to the University, Professor Stoek was appointed by the Governor to two state commissions authorized by the General Assembly. The first of these, the Illinois Mining Investigation Commission, revised the entire mining laws of the State. The second, the Mine Rescue Station Commission, had as its purpose the establishment of three mine rescue stations and the expenditure of a fund of $75,000 for the equipment and operation of these stations.

Professor Stoek was the author of "Economic History of Anthracite" and the "Pennsylvania Anthracite Coal Field". He was editor of "Coal and Metal Miner's Pocket-book," of Fulton's "Coke" and of Lake's "Prospecting for Gold and Silver". He was author of one circular and co-author of three bulletins published by the

Engineering Experiment Station.

He was granted the honorary degree of D.Sc. by the University of Pittsburgh in June, 1920, and by Lehigh University on October 14, 1922, on the occasion of the installation of President Richards. He continued with the University until his death from heart trouble while on an errand in the business district of Champaign, on March 1, 1923.

On Sunday afternoon, May 2, 1926, in the Engineering Library, formal memorial exercises, as indicated below, were held in connection with the presentation of the Stoek Memorial Tablet. The tablet was presented to the University by Professor A. C. Callen, Head of the Department of Mining Engineering. It was received by Professor A. P. Carman, Head of the Department of Physics, as representative of President Kinley. The speakers were Professor Elmer Allen Holbrook, Dean of the School of Mines and Metallurgy of Pennsylvania State College, and Samuel Wilson Parr, Professor of Applied Chemistry at Illinois. Professor A. N. Talbot presided at the exercises. The tablet was made in bronze by Loredo Taft, under instructions from a committee representing his former students, colleagues, and friends to remind coming generations of students of the contributions of Professor Stoek to mining education.[1]

PROGRAM OF MEMORIAL EXERCISES AND
PRESENTATION OF TABLET IN HONOR OF
PROFESSOR HARRY HARKNESS STOEK

Arthur Newell Talbot, Professor of Municipal and Sanitary Engineering and in charge of Theoretical and Applied Mechanics, Presiding

Professor Stoek - Engineer, Editor, and Educator
Elmer Allen Holbrook
Dean of the School of Mining and Metallurgy
Pennsylvania State College

Professor Stoek - Friend

Samuel Wilson Parr
Professor of Applied Chemistry

Presentation of the Stoek Memorial Tablet

Alfred Copeland Callen
Professor of Mining Engineering and Head of the Department of Mining Engineering

1 The Technograph, May, 1926, page 191.

Acceptance of the Memorial Tablet on behalf of the University of Illinois

Albert Pruden Carman
Professor of Physics and Head of the department of Physics

Professor Harold Leroy Walker, in his article entitled "History of the Department of Mining and Metallurgical Engineering at the University of Illinois," published in the Proceedings of the Illinois Mining Institute, 1942, pays the following tribute to the work of Professor Stock: "Doctor Stock's vision, his enthusiasm, and technical ability were responsible for the development of the curriculum, the construction of the equipment of a fine mining laboratory, the securing of a competent staff, and the maintenance of the highest standards of technical instruction".[1]

Doctor Stock was as much admired by his students as he was respected by his colleagues both within and outside of the University circles. He was closely associated with several national scientific organizations and was a frequent contributor to their journals and to other publications of the technical press.

Alfred Copeland Callen - was born in Pen Argyl, Pennsylvania, on July 17, 1888. He was granted the E. M. degree from Lehigh University in 1909 and the M.S. degree in 1911. He was Instructor in Physics at Lehigh in 1909-10 and Instructor in Mining Engineering there in 1910-11, after which he was engaged in engineering practice during 1911-14. He served as Instructor in Mining Engineering at the University of Illinois during 1914-16 and as Associate in Mining Engineering here during 1916-17. He resigned in November, 1916, to become Professor of Mining Engineering and Director of Mining Extension at the University of West Virginia, but returned to the University of Illinois in 1924 as Professor of Mining Engineering and Head of the Department. He maintained that position until 1939, when he accepted a call to become Professor of Mining Engineering and Head of the Department and Dean of the College of Engineering at Lehigh.

During his tenure of office at the University of Illinois, Professor Callen was instrumental in introducing the division of Metallurgical Engineering in 1934,

1 Page 34

since which time the name of the Department has been Mining and Metallurgical Engineering. Professor Callen acted as Editor of a magazine entitled "Coal Mine Management," Chicago, during 1922-29. He served as President of Kiwanis International in 1936-37. He is joint author of five bulletins of the Engineering Experiment Station.

Harold Leroy Walker was born at Benton, Illinois, on June 19, 1905. He was granted the B.S. degree at Michigan College of Mines and Technology in 1932, the M.S. degree in 1933, and the Met.E. degree in 1935. He was engaged in engineering practice during 1925-29, and was Instructor in Metallurgical Engineering at the Michigan College of Mines and Technology during 1932-36. He then went to the State College of Washington, where he became Assistant Professor of Metallurgy and Metallography. He remained with that position until 1937, when he became Assistant Professor of Metallurgical Engineering at the University of Illinois. He was Acting Head of the Department of Mining and Metallurgical Engineering here from 1939 until 1942, having been made Associate Professor of Metallurgical Engineering in 1941. Since 1942, he has been Professor of Metallurgical Engineering here and Head of the Department of Mining and Metallurgical Engineering. In 1943, Professor Walker was awarded the Army-Navy "E" for his work in developing a formula for the production of armor-piercing shells. He is the author of one reprint of the Engineering Experiment Station.

b. Other Professors

Elmer Allen Holbrook (S.B., 1904, Massachusetts Institute of Technology; E.M. 1916, University of Illinois) was employed in mining practice from 1904 to 1910, and was Professor of Mining and Metallurgy at Nova Scotia Technical College at Halifax, from 1910 to 1913. He joined the staff at the University of Illinois in September, 1913, as Assistant Professor of Mining Engineering. He was Professor of Mineral Production here from September, 1917, to October following, when he resigned to accept a position with the U.S.Bureau of Mines. Later, he became Dean of the Schools of Engineering and Mines at the University of Pittsburgh. Professor Holbrook is author of one bulletin and one circular of the Engineering

Experiment Station.

c. Associate Professors

Arthur Joseph Hoskin (B.S. in M.E., 1890, and M.E., 1905, University of Wisconsin) spent several years in mining-engineering practice, then served as Assistant Professor of Mining at Colorado School of Mines during 1905-08, and as Professor during 1908-11. He was engaged in independent practice in Denver and as editor of various mining publications from 1911 to September, 1921, when he came to the University of Illinois as Research Assistant Professor of Mining Engineering. On March 2, 1923, Professor Hoskin was appointed Acting Head of the Department of Mining Engineering to take the place of Professor Stock, who died the day preceding. He served as Research Associate Professor of Mining Engineering and Acting Head of the Department during 1923-24. When Professor Callen became Head of the Department in September, 1924, Professor Hoskin still remained with the Department as Research Associate Professor, but on February 1, 1926, he was given a leave of absence on account of ill health, and he resigned at the end of that school year. He died on March 13, 1935, at Boulder, Colorado. Professor Hoskin was author of a book entitled "The Business of Mining". He was author of one bulletin and was joint author of two more published by the Engineering Experiment Station.

David Ray Mitchell (B.S., 1924, and M.S., 1927, Pennsylvania State College; E.M., 1931, University of Illinois) became Instructor in Mining Engineering at the University of Illinois in February, 1927, after having been employed for some time in engineering practice. He was made Associate in Mining Engineering in 1927, Assistant Professor in 1931, and Associate Professor in 1937. He resigned in September, 1938, to become Head of the Department of Mining Engineering at Pennsylvania State College, where he has remained to date. Professor Mitchell is author of one bulletin and is joint author of two more published by the Engineering Experiment Station.

d. Assistant Professors

Francis Church Lincoln (B.S., 1900, Massachusetts Institute of Technology;

E.M., 1904, New Mexico School of Mines; A.M., 1906, and Ph.D., 1911, Columbia University) became Associate in Mining Engineering at the University of Illinois in September, 1911, and Assistant Professor in 1912. He resigned in August, 1913, to accept a position in mining-engineering practice. Later, he became Director of Mining Schools of Nevada. Professor Lincoln is author of one bulletin of the Engineering Experiment Station here.

Stephen Osgood Andros (A.B., 1897, Bowdoin College; B.S., 1902, and E.M., 1903, Michigan College of Mines) gained teaching experience in secondary schools and in the University of Pittsburgh, then became Field Assistant in the Co-operative Mines Investigation in Illinois in November, 1911. He became Associate at the University in 1913, and Assistant Professor in 1915. He resigned in November, 1915, to enter engineering practice. In 1917-18, he served as Instructor and Assistant Director of the School of Military Aeronautics at the University of Illinois.

Clinton Mason Young (B.S., 1898, Hiram College; B.S., 1904, and E.M., 1909, Case School of Applied Science) served as Assistant Professor of Mining Research from July, 1916, to August 1919, when he resigned to accept a position as Head of the Department of Mining Engineering at the University of Kansas. He was author of two bulletins of the Engineering Experiment Station and a number of articles in the technical press.

John Burns Read (B.S. 1906, and E.M.1909, South Dakota School of Mines) was Assistant Professor of Mining Engineering at the University of Illinois from September, 1919, to September, 1920, when he withdrew to accept an appointment in industry. In 1927, he became Professor of Mining at the Colorado School of Mines.

Arthur Eilert Drucker was graduated from the California School of Mechanical Arts, San Francisco, in 1897 and received the B.S.degree from the University of California College of Mines in 1902. He was engaged in engineering practice in the mining industry in this country and abroad from 1902 to 1919, after which he became Assistant Professor of Mining Engineering at the Wisconsin State School of Mines at Platteville. He then served as Assistant Professor of Mining Engineering

at the University of Illinois from February, 1920, to October, 1926, when he resigned to accept a position as Dean of the School of Mines and Geology and Director of the Mining Experiment Station, at Washington State College.

Ray W. Arms (B.S. 1912, Ohio State University; E.M., 1919, University of Illinois) came to the University in November 1917, as Instructor in Mining Engineering after spending some time in practice. He was made Associate in 1920, and Assistant Professor in 1921, but resigned in November 1922, to engage in employment with the Roberts and Schaefer Company of Chicago. He is author of one bulletin of the Engineering Experiment Station.

Thomas Mellor Bains, Jr., (E.M. 1916, Columbia University) served as Assistant Professor of Mining Engineering at the University of Illinois from January 1923, to September 1924, when he resigned to accept a position at Oregon State College.

Thomas Fraser (B.S., 1917 and E.M., 1921, University of Illinois) was connected with the U.S. Bureau of Mines Experiment Station at the University here from 1918 to 1923 carrying on investigations in coal washing; and in September 1923, was appointed Research Assistant Professor of Mining Engineering. He left the University in September, 1924, to join the teaching staff of the University of West Virginia with the title of Assistant Professor of Mining Engineering. He is joint author of two bulletins of the Engineering Experiment Station.

Irvine Meredith Marshall (B.S. 1920, Queen's University, Canada) was employed in engineering practice after graduation until he came to the University of Illinois in October, 1924, as Assistant Professor of Mining Engineering. He resigned in September 1928, to become Manager of the Central Manitoba Mining Company at Wadhope, Manitoba, Canada.

Cloyde Moffett Smith (B.S. 1920, M.S. 1928, E.M., 1934, and Ph.D., 1935, University of Illinois) was employed in engineering practice during 1920-21, and came to the University in September, 1921, as Assistant in Mining Engineering. In 1923, he was made Instructor in Mining Engineering, and in October 1926, he was transferred from the teaching to the research staff. He was made Research

Assistant Professor in 1931, and remained in that position until October 1937, when he left to become editor of a new publication known as "Mechanization -- the Magazine of Modern Coal". Professor Smith is author of seven bulletins and is co-author of five more of the Engineering Experiment Station.

Arthur B. Wilder (B.S., 1925, Mt.Union College; M.A., 1928, Ohio State University; and D.Sc., 1933, Harvard University) served as Instructor at Case School of Applied Science for one year and as an assistant at Harvard for two years. After 1933, he was engaged for a time in engineering practice at Cleveland, Ohio. He came to the University of Illinois in July 1935, as Assistant Professor of Metallurgical Engineering, and remained in that position until August 1939, when he resigned to return to engineering practice. Professor Wilder is joint author of one bulletin of the Engineering Experiment Station.

Hugh Philo Nicholson (B.S. 1923 and E.M., 1930, Iowa State College; M.S., 1933, University of Illinois) was connected with mining practice after graduation until he joined the staff at the University of Illinois in September 1928, as Instructor in Mining Engineering. He was made Associate in 1934, and Assistant Professor in 1938. He withdrew from the University in September 1942, to become President and General Manager of the Chestnut Hill Zinc Company.

Walter Herbert Bruckner (A.B. 1927, and Ch.E., 1930, Columbia University) joined the staff at the University of Illinois in January 1938, as Research Associate in Metallurgical Engineering. He became Research Assistant Professor in 1939, and has remained here to date (1945). Professor Bruckner is author of one bulletin and is joint author of four more published by the Engineering Experiment Station.

John Louis Gallus Weysser (B.S., 1931 and E.M., 1937, Lehigh University) joined the staff at the University of Illinois in September 1939, as Assistant Professor of Mining Engineering. In November 1941, he was granted a leave of absence to join the staff of the War Production Board at Washington, D.C., but resigned in August 1942, to continue his Government work.

Arthur C. Forsyth (B.S. 1924, M.S., 1929, and Ph.D., 1937, University of

Minnesota) joined the staff at the University of Illinois in September, 1941, as Assistant Professor of Metallurgical Engineering after having spent fourteen years as a member of the faculty of the University of Minnesota. He has remained with the staff to date (1945).

Herman Rath Eberle (B.S., 1922, E.M., 1922, and M.S., 1929, Michigan College of Mines and Technology) served as Assistant Professor of Mining Engineering at the University of Illinois from November, 1941, to August, 1942.

James Warren Stewart (B.S, 1923, University of West Virginia; M.S., 1927, University of Illinois) was employed on the mining staff at Pennsylvania State College and at Lafayette College for fifteen years, then came to the University of Illinois in September, 1942, as Assistant Professor of Mining Engineering, and has remained here to date (1945).

Joseph Arthur Bottomley (B.S. 1930, and E.M., 1944, University of Illinois) served as Special Research Assistant in Mining Engineering at the University of Illinois from January to June, 1936, working under Professor Mitchell on the coal utilization project financed by the Board of Trustees. He took up engineering practice then, but returned to the University in September, 1942, as Assistant Professor of Mining Engineering, where he remained until September, 1944.

Earl Joseph Eckel (B.S. 1937, Michigan College of Mines and Technology) came to the University of Illinois in September, 1939, as Instructor in Metallurgical Engineering. He was appointed Associate in 1943, and Assistant Professor in 1945.

Bernard Gordon Ricketts (B.S., 1937, and M.S. 1938, Washington State College) was connected with the U.S. Geological Survey until he joined the staff at the University as Instructor in Metallurgical Engineering. He was promoted to Associate in 1943, and was granted a leave of absence from November 15, 1944, until Aguest 31, 1945, to work in the U. S. Bureau of Mines Experiment Station at Boulder City, Nevada. He became Assistant Professor in 1945.

e. Associates

James Russell Fleming (E.M. 1911, University of Pittsburgh) served as Junior Mining Engineering with the U.S. Bureau of Mines and as Instructor in the U. S.

[illegible]

School of Military Aeronautics in 1918, and as Research Associate in Mining Engineering at the University from September, 1919, to August, 1921, when he resigned to engage in commercial work. He is co-author of one bulletin of the Engineering Experiment Station.

f. Instructors and Research Assistants

Carl S. Stevenson (E.M., 1908, Ohio State University) was Assistant in Mining Engineering at Ohio State during 1908-09 and was engaged in engineering practice during 1909-10. He came to the University of Illinois in September, 1910 as Instructor in Mining Engineering, but resigned in June, 1911, to re-enter engineering practice.

Herbert Houghton Lauer (E.M., 1906, Lehigh University) followed engineering practice after graduation until he joined the faculty of the University of Illinois in January, 1912, as Instructor in Mining Engineering. He withdrew, however, in July, 1913, to return to engineering practice.

Lewis Emanuel Young (B.S. 1900, Pennsylvania State College; E.M., 1904, Iowa State College; and Ph.D., 1915, University of Illinois) served as Instructor in Mining Engineering at the University of Illinois during the academic year from September, 1913, to June, 1914, and then joined the College of Commerce here where he remained for some time. He is co-author of one bulletin of the Engineering Experiment Station.

Noah Arthur Tolch (B.S. 1924, University of Illinois) was Research Assistant in Mining Engineering from February to August, 1926, when he resigned to accept a position with the U.S. Bureau of Mines.

Rodney Bruce Hoover (B.S., 1925, and E.M., 1925, Michigan College of Mines) served as Special Research Assistant in Mining Engineering here from December, 1928, to June, 1929.

Jerome Ellis Machamor (B.S. 1922, University of Illinois) served as Special Research Assistant in Mining Engineering from December, 1928, to June, 1929.

John Alden Snyder (B.S. 1937, University of Illinois) came to the University in September, 1939, as Instructor in Metallurgical Engineering. He resigned in

February, 1941 to enter engineering practice.

Harold Carl Beede(B.S. 1937, University of Washington) served as Special Research Assistant in Metallurgical Engineering from September 1940 to January 1942, when he obtained a leave to enter service with the U.S.Armed Forces.

Jun Hino (B.S. 1941, and M.S. 1943, University of Illinois) became Research Assistant in Metallurgical Engineering in September, 1941, and continued with the Department until September, 1943, when he left to go into engineering practice.

I. GENERAL SUMMARY

General - Although circumstances seemed to limit the registration of students in courses in mining, the results have justified the efforts. In varying ways a larger service has been given to the State and Nation. A most important service has been the contributions of the members of the staff in the way of bulletins giving reports of investigations and researches of mining problems in connection with the Engineering Experiment Station, the Geological Survey, and the U.S. Bureau of Mines. Since the addition of metallurgical engineering, the enrollment has increased very rapidly, for the vast number and extent of metallurgical industries located in Illinois and neighboring states are calling for more and more men trained for this particular line of service; and no doubt the demands will become even greater as metallurgical engineers continue to demonstrate their value in metal-manufacturing establishments. On this account the Department is practically assured of a continuous and successful career as one of the major units forming the College of Engineering group.

CHAPTER XI

THE DEPARTMENT OF PHYSICS

A. ORGANIZATION OF THE DEPARTMENT

General - It was recognized at the beginning of instruction here that a knowledge of the science of physics, or natural philosophy as it was originally known, was fundamental to the training of every engineer -- that he should become familiar with the laws of mechanics, heat, light, sound, and electricity and magnetism. Accordingly, subjects in physics were taught to engineers from the time of the opening of the University; but in spite of that fact, Physics was not made a separate department until 1889, when Samuel Wesley Stratton was placed in charge with the title of Assistant. Up to that time, responsibility for instruction had been with the heads of the Departments of Mechanical and Mining Engineering, Professor Robinson having served from 1870 to 1878, Doctor Peabody from 1878 to 1885 and Professor Comstock from 1885 to 1889. While the Department has operated as a service organization offering courses to students enrolled in all other departments in engineering and in other schools and colleges on the campus, it has, in addition, within the last few years scheduled its own curriculum of study prepared especially for those undergraduates who desire to specialize in this particular field.

B. EARLY INSTRUCTION IN PHYSICS

General - The 1872-73 issue of the Catalogue[1] stated:

"This subject has been amply provided for in the New Building(University Hall) by the appointment of a Physical Laboratory and Lecture Room, to which the Apparatus will be removed this summer, and where the expected additional instruments necessary to fully illustrate the subject can be accommodated. In connection with the lectures, Silliman's Physics is used as a textbook; as many of the topics are more thoroughly discussed in other classes, special attention is paid to the portions remaining. The following are the main heads: Matter, Force, Motion. Properties and Laws of Solids, Fluids, and Liquids. Acoustics and Optics, with mathematical discussion of the undulations and instruments, solar and stellar spectra, etc. Magnetism. Electricity. Chemical Physics is given in a special course of lectures".

The Catalogue[2] of 1874-75 carried the further information that,

"The department of physics is amply provided with illustrative apparatus, for use in the lecture room, and an extensive physical laboratory has been

1 Page 48
2 Page 49

instituted in the New Building. The laboratory is adjacent to the Physics lecture room; connected by sliding doors so that the apparatus is convenient either for use in the lectures or for the laboratory work. Instruction in physics embraces four kinds of work:

1. Recitation, four exercises a week in which a textbook is used as a guide.

2. Physical experiments one day each week in which the student uses the instruments in testing the principles taught.

3. Illustrative experiments one evening each week in which the more costly apparatus is used before the whole class in such experiments as are difficult to perform, and which are most effective when prepared for an audience.

4. The higher physical experiments by advanced classes, consisting either of research, or of reviews of careful and elaborate experiments previously worked up by others.

The Technograph of 1891-92 furthermore contained the following item:[1]

"The instruction in electricity begins with the third term of physics in the sophomore year. The laboratory work in electricity includes simple problems in electrical measurements, which are designed to acquaint the student with terms and the use of electrical apparatus. Later on the students in advanced classes take up testing of primary and secondary batteries for efficiency, cable testing, designing of electrical machinery, installation of light and power plants, the transmission of power by electricity, and lastly photometry."

An announcement in the 1892-93 issue of the Catalogue appeared as follows:[2]

"The course is intended to give young men the best possible preparation for work in the practical application of electricity. Instruction is given by lectures and laboratory practice. The student is encouraged to add to his general intellectual culture by systematic reading of the best periodical literature in the theory and application of electricity. By keeping himself informed about the efforts of others in every department of his profession, it is hoped that he may be stimulated to independent and original investigation in his own field. To this end a department reading room at all times accessible to students in this course has been recently established, where the leading journals of general physics and applied electricity are kept on file. The instructors meet weekly to discuss the leading articles in these journals. A critical discussion of one or more papers is required from each student".

The Catalogue of 1894-95 set forth the case a little differently:[3]

"The courses in the department are designed to furnish the student who intends to follow the profession of engineering, science teaching, or research in physical science, such a knowledge of the phenomena and laws of physics as may be of greatest use in the chosen calling.

"The instruction is given by means of lectures and by practice in the laboratory. The work in the laboratory consists almost entirely of quantitative measurements made under the personal supervision of the instructors, with instruments of precision. An effort is made to have each student determine for

1 Frontis piece
2 Page 78
3 Page 54

himself the relation existing between the facts which he has observed, in order to stimulate him to the formation of habits of sound thinking".

The work in Physics presented to all students in the College of Engineering, was intended to give such a knowledge of the more important laws and phenomena of physical science as to enable each one to pursue profitably his subsequent technical studies. More extended courses for scientific research were also offered. The work in electrical engineering was given with special reference to the needs of those who were preparing to undertake the practical applications of electricity.[1]

C. ROOM AND BUILDING ACCOMMODATIONS, 1894-1945

General - The opening of Engineering Hall in the fall of 1894, permitted the Department of Physics to move into it from the limited quarters which it had occupied for so many years in the basement and east wing of University Hall. Physics proper was assigned space on the second and third floors of the central or north wing.[2] It had a department office, private studies, and a large lecture room arranged in the form of an amphitheater, furnished with about 200 opera chairs equipped with tablet arms. Piers at the lecture desk and in the center of the room made demonstration with the most delicate apparatus possible. A permanent screen and rolling blinds operated by a motor facilitated illustration by lantern. The four cabinet rooms and the preparation room adjoining the lecture room, were stocked with apparatus suitable for illustration and demonstration, and were provided with conveniences for handling apparatus for lectures.

The general laboratory room 60 feet square occupied the third-floor central wing. It was a well-lighted, well-ventilated room, supplied with tables, shelves, and sink, and was arranged for general experimental work. The cabinet rooms adjoining this general laboratory contained a full line of apparatus suitable for elementary and quantitative laboratory work, and also a line of high-grade apparatus intended for advanced experimental work. By means of a small freight elevator, this room was in direct communication with the rooms on the second floor and the testing rooms on the first floor. The electrical division of the department occupied the central and west wings of the first floor. This group

1 The Technograph, 1894-95, Page 178
2 The Technograph, 1894-95, Page 178

included a drafting room, recitation room, office, and seminary room. In addition, there were six small testing laboratories abundantly supplied with masonry piers wall shelves, sinks, dark curtains, etc., and equipped with apparatus for electrical measurements. It included, also, a constant-temperature room which was insulated from the surrounding space by double masonry walls and double doors, and was arranged for such experiments as required low uniform temperatures. There was a battery room and a number of private studies and laboratories for the storage of instruments and for the use of advanced students and instructors. In the advanced work, the apparatus for special investigations was set up permanently or kept in specially-provided cases. There was a workshop near the small laboratories equipped with machine tools for the manufacture and repair of instruments and other apparatus.

Because the classroom and laboratory facilities of the Department became in time very much overcrowded on account of the comparative large student enrollment and additional quarters seemed necessary, a movement was started in 1904-05 to obtain a new and modern laboratory for the department. In 1906 the General Assembly was asked to make an appropriation for the building, but other interests seemed more urgent. The request was renewed to the next Assembly, and at that time an appropriation was made for buying the grounds at the northwest corner of Mathews Avenue and Green Street as a site for the new building. The General Assembly of 1907 did make an appropriation of $250,000 for a new physics building.

The building was completed for occupancy in the fall of 1909. A suite of three rooms in the southeast corner of the second floor was taken over for departmental offices and a departmental seminary and library.[1] This seminary and library room, still in use, is 19 by 27 feet in plan, and is equipped with fixed book cases, and with special finish and furnishings to make it an attractive room for reading and study purposes. It is supplied with a liberal allowance of reference books and sets of important physics journals and periodicals.

In 1941 the Department took over the garage service building across the Boneyard from the Ceramics Building and remodeled it for housing the large cyclotron

1 Rooms 203 and 205 were taken for offices and Room 201 for the library.

plant which it constructed in it during the next two or three years. In 1941, furthermore, two rooms on the first floor of the east wing of Engineering Hall were taken over for the instructional work in physics given in the survey courses administered by the General Division of the College of Liberal Arts and Science.

D. THE DEVELOPMENT OF LABORATORY FACILITIES IN PHYSICS

General - From the beginning, the instruction in the classroom work in physics has been supplemented by laboratory exercises as equipment could be provided, in order to permit the students to demonstrate the underlying principles of the science to their own satisfaction and to provide some training in the use of precision instruments. The addition of such apparatus has served the purpose, too, of allowing graduate students and the faculty to carry on research projects particularly associated with the subject matter of their special interests. Progress made in the development of some of these facilities is recorded in the following sections.

a. Developments from 1868 to 1909

Early Laboratory Facilities in Physics-1868-1890- The Catalogue and Circular of 1869-70[1] contained the following statement:

"Physics and Natural Philosophy - This collection includes some of the latest and most important improvements in the apparatus of physics and natural philosophy. The air pump is of the best form in use. It was made by the celebrated firm of E. S. Ritchie & Sons, of Boston, and cost $275. It has a rotary movement, combined with 'Ritchie's patent action" of the piston and valves. This final step in the perfection of the air pump furnishes the means for the nearest approach to an absolute vacuum that it is possible to make by mechanical means. The electrical machine is Ritchie's Patent Holtz Machine. This remarkable machine is of recent discovery, and for this reason is found in but few of the cabinets of older institutions of learning. It is distinguished for its wonderful power and great ease of action, rendering it suitable for performing many experiments which, with the ordinary machine, were extremely difficult. The collection also includes a Grove's Battery of six cups, an induction coil, model telegraphic apparatus, Magdeburg hemisphere, vacuum tubes, receivers, magnets, and other accompanying apparatus."

The Catalogue and Circular of 1878-79 bore the following description:[2]

"The Cabinets of the Physical Laboratory contain a collection of apparatus from the most celebrated European and American makers, costing over $5,000 and illustrating the subjects of Mechanics, Pneumatics, Optics, Heat, and Electricity. Ample facilities are afforded to the students for performing experiments of precision by which the theories of Physical Science may be tested and original work may be done".

1Page 20
2Page 20

The collection embraced apparatus for the study of acoustics from R. Koenig of Paris, of heat and molecular physics from Solleron of Paris, and of light, optics, and electricity from Stoehrer of Leipsic and from Browning and Newton of London.

According to the 1882-83 Catalogue and Circular:[1]

"A series of standard weights and measures has been received from the office of the Coast and Geodetic Survey of the U.S.Government and may be consulted at the Physics Laboratory".

A 5-light Weston arc-lighting generator procured in February 1886, was set up in the machine shop, and was connected with the physical and chemical laboratories for experimental purposes.

Pioneer Laboratory Facilities in Electrical Engineering - 1890-1898 - In the fall of 1891, the Head of the Department of Physics, Professor S.W.Stratton, started work in electrical engineering by setting up the nucleus of the first electrical engineering laboratory on the campus. He used a room under the chapel in what was then called the New Building, but later, University Hall. According to the accounts in the University Catalogue and Circular and The Technograph, the division of electrical engineering had, within a short time, developed for its quarters the entire ground floor of the east wing of this building, with each room especially adapted to its distinct purpose and equipped for instruction and experimental purposes. These rooms included a dynamo laboratory, an electrical-measurements laboratory, a battery room, a photometry room, and a tool room and shop.

At first the dynamos were operated by a 10-horsepower "grass-hopper" Atkinson cycle gas engine, but a 60-horsepower "Ideal" high-speed steam engine was soon installed.[2] The dynamos were so connected to the main jack shaft and so arranged that either or both of the engines could be used. The gas engine was soon discarded, however, because of operating difficulties, and the steam engine was used alone. Within a year or so a fairly representative collection of direct-current and alternating-current generators was assembled for instructional and experimental use. The direct-current machinery included a complete Brush 10-light arc

1 Page 24
2 The first units of the University Hall Central Power Plant,whichsee.

lighting plant, complete Thomson-Houston 3-light arc lighting plant, a complete Edison 100-light incandescent plant, and a small Jenny 500-volt power plant. The alternating-current machinery comprised a complete Thomson-Houston 300-light generating plant, two single-phase Westinghouse machines, and a number of transformers.[1]

The electrical-measurements laboratory had necessary piers for the more sensitive instruments, and numerous conveniences indispensable to rapid and accurate measurements. The 1892-93 Catalogue[2] stated in this connection:

"The electrical engineering laboratory has been supplied with apparatus from the leading makers at home and abroad. There are several forms of the Wheatstone bridge, resistance boxes, including an Anthony 100,000-ohm box, a Nadler Bros. subdivided megohm box, an assortment of switches, keys, condensers, and the leading forms of deadbeat and ballistic galvanometers, including a Thompson high resistance, and an Edelman deadbeat galvanometer; also several D'Arsonval galvanometers, and numerous others. Several reading telescopes are used in connection with the galvanometers. The laboratory is also supplied with artificial standards of resistance, standard cells, Kelvin's current balance, ammeters, voltmeters, and watt-meters. Current is brought to the room from the dynamo and battery rooms".

The battery room was provided with a large storage battery made by members of the Department, and a collection of the leading forms of primary cells.

The photometry room was fitted with a Queen & Company's complete electric-light photmeter, numerous types of direct and alternating-current incandescent arc lamps, and conveniences necessary for making complete tests.

The work shop was equipped with a speed lathe, an engine lathe, and a grinder and a line of fine tools suited to the manufacture of special apparatus. An electric motor furnished power for use in this room.

The large lecture room for physics and electrical engineering located on the third floor of the east wing of the building directly above the chapel, was supplied with current from the dynamos and storage battery on the ground floor and was wired for both arc and incandescent lighting.

Later Development of Physical Laboratory Facilities, 1898-1909 - Until 1898, the electrical work was for the most part, in charge of the same man that was head of Physics, and for several years substantially all of the small appropriations

1 The Technograph, 1891-92 front; 1894-95, page 129; and University Catalogue and Circular, 1891-92, page 71; 1892-93, pages 78-79.

2 Page 79

made for these two fields were used in the purchase and installation of electrical apparatus, as was then wise, owing to the rapidly-growing importance of electrical science, and also owing to the fact that the other divisions of Physics had been taught for more than twenty years and presumably were fairly well equipped.

The complete separation of the administration of the work in electrical engineering from the Department of Physics in the fall of 1898, however, gave better opportunity for the development of the work in physics. The equipment of the Department was within the next few years practically all replaced by new and modern apparatus. The rapid increase in the number of engineering students taking required courses in physics made it necessary not only to replace the old apparatus, but also to add very largely to the equipment and also the number of instructors in the Department. This expansion absorbed the energy of the Department for a number of years.

The 1901-02 Catalogue of the University contained the following statement:[1]

"The laboratory contains a large collection of standard electric and magnetic measurement apparatus from the best makers, together with various pieces and devices designed and constructed in the department, so that the facilities for all such work are equivalent to the very best. In optics there are spectrometers, Rowland diffraction gratings (plane and concave), a Fresnal optical bench, a complete photometer bench in a well-equipped dark room, a spectrum photometer, polarization apparatus, etc. The collection also includes apparatus for measurement of precision, such as balances, driving engine, cathetometer, chronograph, Kater's pendulum, thermometers, etc. The workshop of the department is equipped with power lathe, milling machine, and a good collection of tools. The services of a mechanician gave the department facilities for making apparatus from original designs, both for instruction and investigation".

b. Developments from 1909 to 1945

<u>General Physics Laboratories</u> - Since the construction of the Physics Building in 1909, three large well-lighted laboratories have been available for

1 Pages 104-105

experimental exercises supplementing the class room theory taught in elementary physics. These are provided with the usual types of equipment necessary to demonstrate the most common problems in the various branches of beginning courses in physics, thereby enabling the students to check the fundamental principles they learned in their recitation assignments, and to attain some measure of proficiency in the use of facilities ordinarily employed in the conduct of physical research.

Electrical and Magnetic-Measurements Laboratories - The Department of Physics has gradually brought together a complete representative assortment of precision instruments for advanced instructional and experimental use in the field of electrical and magnetic measurements to deal with such subjects as electrostatics and magnetostatics, capacitance and inductance, ferromagnetism, and high-frequency circuits. Such equipment consists of current and ballistic galvanometers, potentiometers, ammeters, resistances, capacitances, inductances, Wheatstone and other types of bridges, oscilloscopes, and cathode-ray and other oscillographs.

Acoustics Laboratories - Sound, of course, has always been one of the major divisions of the field of physics. As new devices became available for use in this particular line, there was accumulated apparatus for determination of pitch and quality and intensity of sound waves; for study of transmission, absorption, and reflection of sound waves; for correcting echoes and reverberations in buildings; and for reducing vibrations set up in machinery. The present apparatus includes such typical appliances as resonators, oscillators and amplifiers, phonographic and other reproduction instruments, microphones, interferometers, oscilloscopes, oscillographs, wave meters, wave filters, and equalizers.

Optical Laboratory - The equipment provided for instructional and experimental work in optics includes different types of filament and arc lamps, photometers, lenses of all kinds, crystals, prisms, filters, magnifiers, and other devices for the study of physical and geometrical optics. It includes also, apparatus for work in reflection, refraction, double refraction, dispersion, interference, polarization, and diffraction of light. There have been accumulated spectrometers for the exact determination of indices of refraction; ruled

gratings and interferometers for determination of wave lengths; polariscopes for study of polarized light; and spectroscopes for study of dispersion.

Spectroscopic Laboratory - A great deal of equipment has been provided for the study of spectroscopy, that branch of physics which deals with the spectra and their analysis. A large Hilger quartz spectroscope made in Europe was received in 1927-28. A microphotometer by Kipp and Zenon, Delf, Holland, was obtained in 1928-29. The instrument was located on the fourth floor of the Physics Building in the spectrum-analysis laboratory, made possible after the removal of the University Blueprinting and Photographic Department from the building in 1924 and 1925, and was used for measuring the intensity of spectrum lines. Other apparatus procured from time to time includes other grating and quartz spectroscopes, filters, prisms, lenses, mirrors, monochrometers, thermopiles, and radiometers for studying the visible, ultraviolet, and infra-red regions of the spectrum. Other accessories include additional spectrophotometers, interferometers, microphotometers, and vacuum spectrographs, one of which is the largest grazing-incidence vacuum spectrograph in the world.

High-Tension Laboratory - When the added space on the fourth floor was made available after 1924-25 by the removal of the University blueprint and photographic apparatus, there was installed in the east wing a 100,000-volt, 60-kilowatt transformer, with rectification by four kenotrons. This new high-tension electrical equipment provided the Department with exceptional facilities for investigational work along several lines, including X-rays, electrical corona discharge, spark spectra, and the testing of insulating materials and dialectrics.

Mass Spectroscopy Laboratory - Mass spectroscopy is that branch of physics which treats of measurement of atomic masses and the determination of the relative abundances of isotopes. For use in the study of subjects in this particular field, a mass spectroscope was constructed at the University by Professor Edward Brent Jordan during the years 1938-41 from funds supplied by the Graduate School. The equipment includes the most powerful mass spectrograph in existence, which is devoted to a determination of the masses of the light elements. The equipment

includes also a relative-abundance spectrometer, which is used for the study of ionization and dissociation of products produced by electron impact on molecules and for the determination of the abundance of these products. The equipment includes, furthermore, a beta-ray spectrograph, used to study the high-speed electrons given off by natural radioactive substances; that is, to measure their energy, the relative number of having a given energy, and to determine the energy of internal conversion gamma rays.

Nuclear Physics Laboratories - A number of machines have been accumulated for work in the comparatively new field of nuclear physics -- that division of physics which deals with the study of atomic nuclei; isotopes; cosmic rays; artificial radio-activity; excitation and transmutation of nuclei; nuclear bombardment properties of protons, deutrons, neutrons, alpha, beta, and gamma rays; electrons and positrons; and artificial disintegration. One of the high-tension electrostatic machines is the Van de Graff generator which was built at the University here during 1937-39 from funds supplied by the Graduate School. This piece of apparatus consists of endless belts of balloon fabric that travel in a vertical plane through an insulating column into a large metal sphere producing potentials around 500,000 volts. In addition to use in nuclear disintegration experiments, this machine is also useful in connection with high-potential vacuum-tube work, and with corona and electrical surge investigations. Another of the electrostatic machines is the linear accelerator, in the operation of which, protons or deutrons are accelerated from the bottom of the instrument; and as they move upwards under the force of electric fields, they produce particles whose energy is approximately 500,000 electron volts. Another type of machine in this field is the cyclotron. In 1935-36, there was constructed under the immediate supervision of Professor P. Gerald Kruger, a member of the Physics staff, a seven-ton electro-magnet in the Physics Building as a cyclotron for the study of nuclear physics. The instrument is capable of developing energy of 2,000,000 electron volts, which gives the particles a velocity of about 12,000 miles a second. The Department has another one of these machines -- one of the largest in the United States. It was designed

and built in place during 1940-43 under direction of Professor Kruger, and is housed in a separate building known as the Nuclear Radiations Laboratory, which is devoted entirely to the use of this equipment. It is a direct-current machine, so constructed as to be able to produce protons having an energy of 30,000,000 electron volts. Still another machine is the betatron, sometimes known as the "induction electron accelerator". It is an alternating-current mechanism invented in 1940 by Professor Donald William Kerst, a member of the Physics staff here, and developed by him during the years immediately following its discovery. A number of these machines have been constructed in the Physics Building for experimental purposes, but the largest one so far developed here was recently built in the basement of the William Abbott Power Plant. This one is capable of accelerating negatively-charged electrons until they attain a speed almost comparable to that of light and equivalent to that produced by a potential of 20,000,000 electron-volts. This type of machine will accelerate electrons to higher energies than can be obtained by any other laboratory equipment so far devised; and on this account it is opening up an unlimited range of study in the field of nuclear phenomena, and no doubt, is the most outstanding development of physics made within recent years.

Photograph Laboratory - Work in the photograph laboratory was begun about 1937-38. The equipment has been gradually extended from time to time since then and includes apparatus and materials required to conduct experiments in color photography, color sensitivity, infra-red and ultra-violet rays, cinematography, stereoscopic photography, photomicrography, and aerial photography.

E. PHYSICS SEMINARS

Physics Colloquim - The Physics Colloquium, started about 1905 as a means for bringing together persons interested in the discussion of recent developments and current problems in physics and allied branches, especially of work being done at the University here, has continued to the present time. Most of the discussions center around organized research being carried on by members of the faculty and advanced students. The organization serves as a means for disseminating new facts

and provides a source of inspiration to others who are engaged in research or are interested in becoming research workers. The meetings are held weekly during the academic year, and graduate students are expected to attend.

<u>Other Seminars</u> - Other seminars which have held or are now holding meetings regularly throughout the academic year for students enrolled in physics courses include Seminar in Theoretical Physics, Spectroscopic Seminar, Physics Journal Club, Nuclear Seminar, and Applied Physics Club. The programs scheduled once a week sometimes during the afternoon and sometimes during the evening hours, have featured papers or discussions by members of the staff including student assistants and by students registered in graduate courses in this Department.

F. TOTAL ENROLLMENT IN PHYSICS

<u>Total Registration in Physics Courses, 1907-1944</u> - The total registration in courses given by the Department of Physics for all students of both undergraduate and graduate grade in all departments of the University during the school years 1907-08 to 1943-44 inclusive is given by the following table:

TABLE XVIII -REGISTRATION IN PHYSICS COURSES 1907-1944

Year	First Semester	Second Semester	Summer School	Total
1907-08	944	860		1804
1908-09	1035	1012		2047
09-10	930	832		1762
10-11	991	865		1856
11-12	987	836		1833
12-13	816	767		1583
13-14	982	899		1881
14-15	1020	946		1966
15-16	1041	924		1965
16-17	1088	921		2009
17-18	862	652	87	1601
18-19 [1]	750	693(quarter) 532	56	2031
19-20	1562	1255	75	2892
1920-21	1498	1366	192	3056
21-22	1394	1109	240	2743
22-23	1416	1151	187	2754
23-24	1194	1011	84	2289
24-25	1231	1011	158	2400
25-26	1434	1221	168	2823
26-27	1620	1316	154	3090
27-28	1680	1385	202	3267
28-29	1736	1294	158	3188
29-30	1659	1361	181	3201
30-31	1905	1592	215	3712
31-32	1905	1719	275	3899

1 Quarter plan

Year	First Semester	Second Semester	Summer School	Total
32-33	1607	1373	247	3227
33-34	1486	1232	221	2939
34-35	1444	1229	202	2875
35-36	1499	1320	172	2991
36-37	1785	1607	166	3588
37-38	2089	1756	214	4059
38-39	2145	1756	199	4100
39-40	1854	1526	209	3589
40-41	1823	1565	191	3579
41-42	1925	1659	104	3688
42-43[1]	1822	1395	488	3705
43-44[1]	746	514	655	1915

G. FACULTY PERSONNEL

General - Brief biographical sketches of members of the staff above the grade of assistant that have been connected with the Department of Physics are listed in the next few pages in chronological order according to rank.

a. Heads of the Department

General - Stillman Williams Robinson served as Professor of Mechanical Engineering from 1870 to 1878 and was in charge of Physics during those years. Selim Hobart Peabody was made Professor of Mechanical Engineering and Physics in 1878; and although he became Acting Regent in 1880 and Regent in 1881, he continued to teach subjects in Physics.

Theodore B.Comstock was Professor of Mining Engineering and Physics from 1885 until 1889. From 1889 to 1892, Samuel Wesley Stratton was in charge of the Department of Physics and Electrical Engineering. Daniel W. Shea was Head of the Department of Physics from 1892 to January, 1896, and Fred Anson Sager and Bernard V. Swenson looked after the affairs of the Department during the remainder of the academic year 1895-96. Albert Pruden Carmen served from September 1896, until September 1929, and F. Wheeler Loomis from 1929 to date (1945). During the years when Professor Loomis was absent from the University for service in the Federal Government, P. Gerald Kruger served as Acting Head of the Department. The biographies of these men follow.

Stillman Williams Robinson was in charge of the work in Physics during 1870 and through 1878 while he was Professor of Mechanical Engineering, for although Physics was not made a separate department until 1889, subjects in that field were

1 Three-semester plan

listed in the University Catalogue and Circular almost from the beginning of the institution. The scope and novelty of the instruction given by Professor Robinson deserve special attention.

The recitation instruction was based upon a textbook, but the work was much more invigorating and stimulating than merely questions and answers upon the text. The professor was fertile in showing the relations of the principles of the lessons to the phenomena in nature or to practice in the industries, in suggesting puzzling relations which he asked the student to explain by applying the principles of the text, and in proposing practical problems. For example, when the class was studying mathematical optics, he proposed for a problem the design of a spectacle lens which should be free from the reflection that frequently annoys the auditors of a public speaker. He steadily declined to offer any help to the few students who accepted the challenge and attempted to solve the problem; but when the students finally brought in an answer that he said was fairly satisfactory, he showed them another and better solution.[1]

He employed no demonstrating apparatus in the daily recitation; but one night a week called his students together for an extra class exercise which was largely a demonstration lecture. Many of his comments and experiments were striking and stimulating. A considerable number of students not members of the class attended these lectures. Again, one example must suffice. Before the days when a professor of Physics had an unlimited electrical current at his command by simply turning a key on his lecture room desk, Professor Robinson used two hundred platinum-acid porous-cup batteries to generate an electrical current, and with poor lenses and prisms set up a table, projected the spectra of metals as large as the side of his lecture room, and discussed before his students the bearing of certain features of these upon the then current theories of the physical constitution of the atmosphere of the sun.

But unfortunately, Professor Robinson was not a ready or fluent speaker, although he wrote fairly well. Even before his own class, he was timid and diffident, and his enunciation was low and often indistinct; and before a larger group

1 It is interesting to note that in 1911, practically 40 years after the above, and a year and a half after his death, Professor Robinson was allowed a patent on a machine for grinding bifocal spectacle lenses.

it was often painful to see and hear him, particularly if he was explaining something that was original with him. However, notwithstanding the defects of public speech, the lectures were well attended and the students were interested.

Professor Robinson inaugurated laboratory practice in physics in January 1875 -- a time when there was little or no laboratory practice in colleges, and probably none in high schools. The only other laboratory work of any kind at the University then was in chemistry and botany; and the only other institutions then offering laboratory practice in physics were Stevens Institute of Technology and Massachusetts Institute of Technology, the first beginning such work in 1871 and the latter in 1873. Physics laboratory work was taken by all juniors during the second and third terms. No list of the twenty or twenty-one experiments can now be found; but at least twenty of the experiments then given are now included in the one year laboratory work offered by any institution noted for the excellence of its work in physics; and it is known that Professor Robinson's list included two elaborate experiments not found in the modern list. The equipment was meager, much of the apparatus being made in the shop or improvised in the laboratory. A long-hand manuscript description of each experiment was handed to each student when the problem was assigned the week before it was to be performed; and each student was required to submit a formal report -- for which no form was provided. The most of the students were intensely interested in the work; and although the laboratory period was two hours a week, a majority of the class put in two or three times the minimum requirement; and there was strong competition as to the appearance and completeness of the reports and the accuracy of the results.

<u>Selim Hobart Peabody</u> - See Regents, Chapter II, and Mechanical Engineering Chapter VII.

<u>Theodore B.Comstock</u> - See Mining and Metallurgical Engineering, Chapter X.

<u>Samuel Wesley Stratton</u> was born at Litchfield, Illinois, on July 18, 1861. He was graduated from the Mechanical Engineering curriculum at the University of Illinois in 1884 and served as an instructor in mathematics and physics in the Preparatory Department during 1885-87, and as Assistant in Architecture during 1887-89. In September 1889, he was made responsible for the work in Physics, which

from 1870 to 1885, had been assigned to the Professor of Mechanical Engineering and from 1885 to 1889 to the Professor of Mining Engineering. He began with the title of Assistant[1] even though he was in charge of the new department, but in 1890 he was given the title of Assistant Professor, and in 1891 that of Professor of Physics and Electrical Engineering.

His work in Physics attracted the attention of the entire University and aroused the highest enthusiasm of his students, because of his ability in presentation, in devising experiments, and in making apparatus. Under his direction was established here in 1891-92 the first instruction in electrical engineering and the nucleus of the first electrical engineering laboratory in the room under the chapel or east wing in what was then called the New Building, but later University Hall.

Primarily on account of his low salary, he resigned in June 1892 to accept a position in the Department of Physics of the New University of Chicago. There he served for nine years and became in succession, Assistant, Assistant Professor, and Professor. In 1901 he became the first Director of the National Bureau of Standards, then being organized from the old Bureau of Weights and Measures; and under his direction that Bureau became one of the most important of the many scientific organizations of the Federal Government. In 1923 he was elected President of the Massachusetts Institute of Technology.

Professor Stratton was honored with the degree of D.Eng. by the University of Illinois in 1903; the D.Sc. degree by Western University of Pennsylvania (now the University of Pittsburgh) in 1903, by Cambridge in 1909, and by Yale in 1919; the LL.D. degree by Harvard in 1923; and the Ph.D. degree by Renneselaer in 1924. He died on October 18, 1931 at the age of 70.

Daniel William Shea was born at Portsmouth, New Hampshire on November 27, 1859. He received the A.B. degree at Harvard University in 1886, ~~the A.M. degree at Harvard University in 1886~~, the A.M. degree there in 1888, and the Ph.D. degree

1 This was an unusual case. The Professor of Mining Engineering and Physics had failed to return to the University in the fall after the long summer vacation, and Mr. Stratton was asked to take over the work under the emergency conditions.

at Freiderich Wilhelms Universitat in 1892. Mr. Shea was Assistant in Physics at Harvard during 1888 and 1892. He came to the University of Illinois in September 1892, as Assistant Professor of Physics in charge of the Department and served as Professor of Physics during 1894-95. Professor Shea moved the Department from its cramped quarters in University Hall to the commodious rooms in the new Engineering Building, or Engineering Hall as it is now known. He very materially increased the equipment and extended the scope of the work, particularly in electrical engineering. In January 1896 he resigned to become the first Professor of Physics in the Catholic University of America at Washington, D.C. Later he became Dean of the Faculty of Science at that institution.

Albert Pruden Carman was born at Woodbury, New Jersey, on July 15, 1861. He received the A.B. degree at Princeton University in 1883, the A.M. degree there in 1885, and the Sc.D. degree in 1886. He studied also in Berlin and Vienna during 1888-90. Doctor Carman became Instructor in Physics and Mathematics at Princeton in 1884 and remained there in that capacity until 1888. He was made Professor of Physics and Electrical Engineering at Purdue University in 1890 and Professor of Theoretical Physics at Stanford University in 1893. He came to the University of Illinois in September, 1896, as Professor of Physics. During the time that Professor Carman was in charge of the Division of Electrical Engineering he was in responsible charge of equipping the new lighting and power plant (the Boneyard Plant) of the University, which was installed in the rear portion of the Mechanical and Electrical Engineering Laboratory Building in 1898.

After electrical engineering became a separate department in 1898, Professor Carman continued as Head of the Department of Physics. One of his duties was to supervise the production of plans for the construction of the Physics Building which was erected in 1908-09. In the new quarters Professor Carman continually developed the equipment and instruction until the Department became one of the leading organizations of its kind in this country, and for many years now, it has continued to attract a considerable number of graduate students. Professor Carman remained as Head of the Department until September 1, 1929, when he reached

the age limit prescribed by statutory regulations and was retired with the title of Professor of Physics, Emeritus. After his retirement, Doctor Carman continued to live in Urbana.[1] He is author of one bulletin and is co-author of two more of the Engineering Experiment Station. He is also author of the section on Electricity and Magnetism in Alexander W. Duff's "Physics for Students of Science and Engineering".

Francis Wheeler Loomis was born at Parkersburg, West Virginia, on August 4, 1889. He received the A.B. degree at Harvard University in 1910, the A.M. there in 1913, and the Ph.D. degree there in 1917. He served as Instructor at Harvard during 1913-15 and as Research Physicist with the Westinghouse Lamp Company during 1920-22. He then served as Assistant Professor of Physics at New York University from 1920 to 1922, and Associate Professor of Physics there from 1922 to 1929, at the end of which time he joined the faculty of the University of Illinois as Professor of Physics and Head of the Department. During World War II, Professor Loomis was on leave from the University to carry on research work for the Government in the Radiations Laboratory at Massachusetts Institute of Technology. He is co-author of a publication entitled "Molecular Spectra in Gases" issued by the National Research Council.

b. Other professors

Charles Tobias Knipp (A.B., 1894 and A.M., 1896, Indiana University; Ph.D., 1900, Cornell University) served as Instructor and Assistant Professor of Physics at Indiana University between 1893 and 1903. He became Assistant Professor of Physics at the University of Illinois in 1903, and was made Associate Professor in 1915 and Professor of Experimental Electricity in 1917. Professor Knipp is an outstanding experimentalist, and has designed many electrical devices used in radio and other branches of physics and electricity, and has made many contributions to the body of knowledge in matters relating to his particular field of interest. He is co-author of one bulletin issued by the Engineering Experiment Station, and is author of the section "Conduction of Electricity through Gases" in Duff's "Physics for Students of Science and Engineering". He was Vice-President of the State Academy of Science in 1920-21 and President in 1921-22. He was

1 Professor Carman died on February 10, 1946.

a member of the Advisory Sub-committee on Physics for the Century of Progress Exposition in Chicago in 1933. In 1937, Professor Knipp reached the University age limit, and was retired with the title Professor of Experimental Electricity, Emeritus. In the fall of 1942, he accepted an invitation to take active charge of the Department of Physics at Rollins College, Florida, and has remained there to date (1945).

Floyd Rowe Watson (B.S. 1899, University of California; Ph.D. 1902, Cornell University) served as Assistant in Physics at the University of California during 1897-99, after which he came to the University of Illinois and became in turn Instructor, Assistant Professor, and Associate Professor of Physics during 1899 and 1917. In 1907-08, Professor Watson served as first part-time Assistant Dean of the College of Engineering, giving attention to student records and matters of that kind. In 1917, he became Professor of Experimental Physics, and later produced three bulletins and was joint author of one more in the field of acoustics for the Engineering Experiment Station. In 1940, he reached the University age limits and was retired with the title Professor of Experimental Physics, Emeritus. He is author of a textbook entitled "The Acoustics of Buildings," and of one chapter on Acoustics of Buildings in Kidder-Parker "Architects and Builders Handbook". During World War II, Professor Watson was engaged in National Defense Work at Washington, D.C.

Jakob Kunz (Ph.D. 1902, Eidg.Polytechnicum, Zurich, Switzerland) was engaged in engineering practice during 1902-04, and served as "Privat-Dozent" in mathematical physics at the Polytechnicum during 1904-07. He studied in Cambridge, England, during 1907-08 and was Instructor in Physics at the University of Michigan during 1908-09. He joined the College staff here in September, 1909, as Assistant Professor of Mathematical Physics. He was made Associate Professor in 1915 and Professor in 1923. In 1909 he developed the photoelectric cell and spent the next two years in perfecting it. This was such an extraordinary development that it served to revolutionize many processes in industrial practice; and on that account has come to be widely adopted in many phases of commercial enterprise.

Being an outstanding analyst, Professor Kunz for many years carried practically all of the responsibility for the instruction of graduate students in theoretical physics. He himself did a great deal of experimental work in a variety of subjects, and was co-author of two bulletins published by the Engineering Experiment Station. He was author of "Induction der Drehfeldern rotierenden Kugeln aus der Lammlung electrotechnischer Vortrage," "Teilbarkeit der Materie," and "Theoretische Physik auf Mechanischer Grundlage Eneke". Professor Kunz continued with the University until his death on July 18, 1938.

Peter Gerald Kruger (A.B. 1925, Carleton College; Ph.D. 1929, Cornell University) studied in this country and abroad and served as Instructor in Physics at Cornell during 1925-26 and 1927-29. He joined the staff at the University of Illinois in 1931 as Assistant Professor of Physics and became Professor of Physics in 1936. Professor Kruger has given considerable attention to the development of the cyclotron for work in nuclear physics and supervised the construction of the cyclotron plant at the University -- the largest of its kind in existence. He served as Acting Head of the Department of Physics during the absence of Professor Loomis from 1941 until the close of the war.

Gerald Marks Almy (B.S. 1924 and M.S. 1926, University of Nebraska; Ph.D. 1930, Harvard University) became Instructor in Physics at the University of Illinois in September 1930, Associate in 1933, Assistant Professor in 1935 and Professor in 1943.

Donald William Kerst (B.A. 1934, and Ph.D. 1937, University of Wisconsin) served as a teacher at the University of Wisconsin and as a research worker with the General Electric Company, then in 1938 became Instructor in Physics at the University of Illinois. He was made Assistant Professor in 1940, Associate Professor in 1942, and Professor in 1943. As previously stated, Professor Kerst is the discoverer of the betatron, an instrument that shows outstanding possibilities in the field of nuclear physics. For his remarkable work in this connection, he was awarded the Comstock Prize of The National Academy of Science at its fall meeting in 1943. This award, made only once every five years, represents a very

unusual recognition and a mark of great distinction, going to that person who made the most extraordinary contributions to the fields of electricity and magnetism or radiant energy during the period. He was given a leave of absence on November 1, 1943, for war service.

Harold Meade Mott-Smith (A.B. 1919, Cornell University; Ph.D. 1933, University of Illinois) became Assistant Professor here in 1934 and Associate Professor in 1939. On September 1, 1941, he was given a leave of absence for war service, with the Bureau of Ordnance, U.S. Navy, and in September, 1944, was made Professor of Physics.

Leland John Haworth (A.B. 1925, and A.M. 1926, Indiana University; Ph.D. 1931, University of Wisconsin) became Associate in Physics here in September, 1938, after having had several years teaching and research experience at the University of Wisconsin and at Massachusetts Institute of Technology. He was made Assistant Professor in 1939 and was given a leave of absence on October 1, 1941, for war service in the Radiations Laboratory of Massachusetts Institute of Technology. In September, 1944, he was made Professor of Physics.

James Holley Bartlett, Jr. (B.C.E. 1924, Northeastern University; A.M. 1926, and Ph.D. 1930, Harvard University) became Assistant Professor of Physics at the University of Illinois in September, 1930, Associate Professor in 1937, and Professor in 1945.

Robert Serber (B.S. 1930, Lehigh University; Ph.D. 1934, University of Wisconsin) was made Assistant Professor of Physics at the University of Illinois in September, 1938, Associate Professor in 1941, and Professor in 1945. On September 1, 1942, he was given a leave of absence for war service.

Moritz Goldhaber (Ph.D. 1926, Cambridge University, England) came to the University from the Cavendish Laboratory in Cambridge, England, on September, 1938, as Assistant Professor of Physics. He was promoted to the title of Associate Professor in 1943, and of Professor in 1945.

c. Associate Professors

William Frederick Schulz (B.E. 1893 and Ph.D. 1908, John Hopkins University; E.E. 1900, University of Illinois) served as Instructor in Physics at the University of Illinois from 1900 to 1906, as Assistant Professor from 1908 to 1925, and as Associate Professor from 1925 to 1940, when he was retired under University regulations to become Associate Professor of Physics, Emeritus. Professor Schulz is author of a textbook entitled "Manual of Experiments in General Physics".

Elmer Howard Williams (A.B. 1905 and A.M. 1906, University of Wisconsin; Ph.D., 1910, University of Illinois) served as Instructor in Physics here during 1907-12, as Associate during 1912-18, as Assistant Professor during 1918-29, and as Associate Professor from 1929 to date. Professor Williams is author of one bulletin published by the Engineering Experiment Station.

Robert Frederick Paton (A.B. 1915, A.M. 1916, and Ph.D. 1922, University of Michigan) was a teacher in the University of Michigan until 1918. He then taught in Western Reserve University during 1919-20, and returned to the University of Michigan and taught there during 1920-22. He joined the staff at the University of Illinois in September, 1922, as Associate in Physics. He was advanced in position until he became Associate Professor of Physics in 1929. He is joint author of one bulletin issued by the Engineering Experiment Station. He is also co-author of a textbook entitled "Physics for Colleges"

Ernest McIntosh Lyman (B.A. 1931, Pomona College; M.A. 1933, Dartmouth College and Ph.D. 1938, University of California) joined the staff at the University of Illinois in September, 1938. He was given a leave of absence on September 1, 1941, to engage in war work. He was made Assistant Professor in September, 1944, and Associate Professor in 1945.

Sidney Michael Dancoff (B.S. 1934, Carnegie Institute of Technology; Ph.D. 1939, University of Pittsburgh) became Instructor in Physics in September, 1940, and Associate in February, 1942. He remained with the University until June, 1943, when he joined the staff of the Metallurgical Laboratories at the University of

Chicago. He returned to the University of Illinois in October, 1945, as Associate Professor.

d. Assistant Professors

Fred Anson Sager (B.S. 1894, University of Michigan) served in turn as Assistant in Physics, Instructor, and Assistant Professor of Physics from 1894 to 1903, when he withdrew to engage in engineering practice in Chicago.

Oscar Quick (A.B. 1895, and A.M. 1896, Harvard University) served as Assistant in Physics at the University of Illinois during 1895-96, Instructor during 1896-98, and Assistant Professor during 1898-1902. He withdrew to engage in commercial work, but later joined the staff at the U.S. Patent Office.

Earl Emanuel Libman, who had previously been a member of the faculties of the Department of Ceramic Engineering and Mathematics at the University of Illinois, joined the staff in the Department of Physics in September, 1927, as Assistant Professor of Physics. He withdrew, however, in August, 1929, to accept an appointment with the General Electric Company.

John Reginald Richardson (B.A. 1933, University of California at Los Angeles; Ph.D. 1937, University of California at Berkeley) joined the Physics staff here in September, 1938, as Assistant Professor of Physics. He was given a leave of absence in September, 1942, for war service, but resigned at the end of the 1944-45 academic year.

John Henry Manley (B.S. 1929, University of Illinois: Ph.D. 1934, University of Michigan) was engaged in practice during 1930-31, served as Instructor at the University of Michigan during 1931-33, and as Lecturer at Columbia University during 1934-37. He became Associate in Physics at the University of Illinois in 1937 and Assistant Professor in 1941. He was given a leave of absence on February 1, 1942, to engage in war work, but resigned at the end of the school year 1944-45.

Edward Brent Jordan Jr. (A.B. 1928, Colorado College; M.S. 1930, University of Washington; and Ph.D. 1933, University of California) became Instructor in Physics at the University of Illinois in 1937, Associate in 1938, and Assistant Professor in 1941. He resigned in February, 1943.

Richard Henry Bolt (A.B. 1933, and M.A. 1937, University of California, and Ph.D. 1939, University of California at Los Angeles) became Associate in Physics in September, 1940, and Assistant Professor in 1943. On September 1, 1941, he was given a leave of absence for war research abroad.

Emil J. Hellund (B.S. 1935, and Ph.D. 1939, University of Washington) was appointed Assistant Professor of Physics in November, 1944, and remained with the University until October, 1945.

Herbert Arnold Nye (A.B. 1936, Allegheny College; A.M. 1938, and Ph.D. 1941, University of Illinois) became Instructor in Physics here in September, 1941, Associate in 1944, and Assistant Professor in 1945.

Guenter Schwarz (Diploma Engineer, 1938, Technical High School, Berlin-Charlottenburg; Ph.D. 1941, Johns Hopkins University) became Instructor in Physics in September, 1942, and Assistant Professor in 1945.

Gail Dayton Adams, Jr. (B.S. 1940, Case School of Applied Science; M.S. 1942, and Ph.D. 1943, University of Illinois) was appointed Research Physicist here in September, 1943, and Research Assistant Professor (Betatron research) in 1945.

Herman William Koch (B.S. 1941, Queen's College; M.S. 1942 and Ph.D. 1944, University of Illinois) became Research Physicist in September, 1943, and Research Assistant Professor (Betatron research) in 1945.

e. Associates

William Howard Sanders (A.B. 1920, A.M. 1922, and Ph.D. 1925, University of Illinois) became Assistant in Physics in 1920, Instructor in 1926, and Associate in 1930. He resigned in August, 1934.

Norman Foster Ramsey (B.A. 1935, and Ph.D. 1940, Columbia University; B.A. 1937, and M.A. 1941, Cambridge University, England) became Associate in Physics in September, 1940. He was on leave from November 7, 1940 to August 31, 1941 on National Defense, but did not return to the University.

Lyle Winston Phillips (B.S. 1932, North Dakota State College; M.S. 1935, University of Buffalo; and Ph.D., 1939, University of Illinois) was made Instructor

in Physics at the University here in September, 1940. He became Associate in 1942 and remained with the Department until July, 1944.

John Paul Girard (B.S. in E.E. 1938, Purdue University) became Research Engineer in Physics in September, 1942, and remained here until October, 1945.

John McElhinney (B.S. 1942, Ursinus College; M.S. 1943, University of Illinois) was made Special Research Associate of Physics in April, 1944.

Warren Harding Smith (A.B. 1942, Colgate University; M.S., 1943, University of Illinois) became Research Physicist in February, 1944, Special Research Physicist in May, 1944, and Special Research Associate in September, 1944. He resigned in January, 1946.

Lloyd Smith (A.B. 1942, and M.A., 1943, University of Illinois) was appointed Special Research Associate of Physics, effective September 1, 1944. He left the Department in September, 1945.

Gerhart Karl Groetzinger (Ph.D. 1931, University of Vienna) became Instructor in Physics in September, 1942, and was made Associate of Physics in September, 1944. He left his position in June, 1945, to accept an appointment at Ohio State University.

Vail Hall Moore, (see Civil Engineering) was appointed Associate in Physics for the first semester of 1944-45. During this period, as well as that with Civil Engineering, Mr. Moore was on leave of absence from the State Geological Survey.

f. Instructors and Research Assistants

Burton Evans Moore (A.B. 1888, Otterbein University; A.M. 1890, Cornell University; and Ph.D. 1907, University of Goettingen) served as Instructor in Physics at Lehigh University during 1891-92, and at the University of Illinois during 1894-95. He resigned to accept a position at the University of Nebraska.

Hubert Vinton Carpenter (B.S. in E.E. 1897, and M.S. in Mathematics and Physics, 1899, University of Illinois) served as Assistant and Instructor in Physics here from 1897 to 1901, and then became Assistant Professor of Physics and Electrical Engineering at the State College of Washington. He was Head of the Department of Mechanical and Electrical Engineering there from 1903 until 1917, when he became Dean of the College of Mechanic Arts and Engineering. In 1919, in addition, he was made Director of the Engineering Experiment Station. He served

also as Consultant to the Natural Resources Planning Board. Professor Carpenter was honored by his College with the degree of LL.D. in 1938. He remained with the institution until his death on November 15, 1941.

Alfred Higgins Sluss (B.S. in M.E. 1901, University of Illinois) served as Instructor in Physics here from 1902 to 1907. He left the University to take up commercial work, but later joined the faculty of the University of Kansas.

Claude Silvert Hudson (B.S. 1901, and M.S. 1902, Princeton University) continued in study at home and abroad after graduation and then served as teacher at Princeton. In 1905, he came to the University of Illinois as Instructor in Physics, but withdrew in 1907 to accept a position with the Federal Government.

Fay Cluff Brown (A.B. 1904, Indiana University; A.M. 1906, University of Illinois) served as Instructor in Physics at the University here during 1906-07. Later he became Director of the Industrial Museum at Scarborough-on-Hudson, New York.

Waldeman Matthaeus Stemple (A.B. 1905, Indiana University; A.M. 1906, University of Illinois) after further study at Cornell University, became Instructor in Physics at the University of Illinois in 1907. He remained here until 1911, when he resigned to engage in engineering practice.

Thomas Smith Taylor, Jr. (A.B. 1906, and Ph.D. 1909, Yale University) became Instructor in Physics at the University of Illinois in 1909, and remained here until 1912, when he resigned to accept a position in England.

William Warren Stifler (A.B. 1902, Shurtleff College; A.M. 1908, and Ph.D. 1911, University of Illinois) taught four years at Ewing College, then joined the College staff here as Assistant in Physics. He served in that capacity during 1907-09, and then as Instructor during 1909-10, after which he withdrew to accept an appointment at Columbia University.

Lloyd Theodore Jones (A.B. 1909, and A.M. 1910, Lake Forest College; M.S. 1912, and Ph.D. 1915, University of Illinois) served as teacher of Physics at Lake Forest during 1909-10 and as Assistant in Physics and as Instructor in Physics at the University of Illinois during 1910-15. He resigned to accept a position at

the University of California.

Jay Walter Woodrow (A.B. 1907, Drake University; A.B. 1910, Oxford, England) served as Instructor in Physics at the University here during 1910-12, after which he resigned to go to Yale University, where he received the Ph.D. degree in 1913.

John Wesley Hornbeak (B.S. 1906, Illinois Wesleyan College; A.M. 1909, and Ph.D., 1913, University of Illinois) became Instructor in Physics here in 1911, but withdrew in 1913 to accept a position at Carleton College.

Glenn Alfred Shook (A.B. 1907, University of Wisconsin; Ph.D. 1914, University of Illinois) served as Instructor in Physics at Purdue University during 1907-11, then joined the Physics staff at the University of Illinois in 1911 as Instructor. ~~He remained here until 1911 as~~ Instructor. He remained here until 1914, when he withdrew to accept an appointment at the University of Michigan.

Earle Horace Warner (B.S. 1912, University of Denver; A.M. 1914, and Ph.D. 1918, University of Illinois) was Assistant in Physics during 1913-17 and Instructor here during 1913-18, after which time he withdrew to engage in engineering practice.

Sebastian Karrer (A.B. 1911, and A.M. 1913, University of Washington; Ph.D. 1918, University of Illinois) served successively as Assistant in Physics and as Instructor in Physics here from 1913 to 1919.

William Henry Hyslop (A.B. 1908, Knox College; A.M. 1911, and Ph.D. 1920, University of Illinois) served as Assistant in Physics during 1914-18, and as Instructor during 1918-21.

Roy Andrew Nelson (B.S. 1916, Knox College; M.S. 1920, and Ph.D. 1923, University of Illinois) was Assistant in Physics here during 1919-23 and Instructor during 1923-25. Later, he became Professor of Physics at Cornell College.

Clifford Nathan Wall (A.B. 1922, M.S. 1923, and Ph.D. 1926, University of Illinois) served as Assistant in Physics here from September 1922, to September 1926, when he became Instructor. He resigned in 1928.

Keron Caldwell Morrical (B.S. 1929, M.S. 1933, and Ph.D. 1936, University of Illinois) served as Special Research Assistant in Physics during 1933-34, and as

Assistant in Physics during 1934-36.

John Joseph Gibbons (A.B. 1928, M.S. 1930, and Ph.D. 1933, University of Illinois) served as Assistant in Physics during 1935-36 and as Instructor in Physics during the academic year 1936-37.

Harold Q. Fuller (A.B. 1928, Wabash College; A.M. 1930, and Ph.D. 1932, University of Illinois) after serving as Instructor in Physics at Illinois College during 1933-35 and as Assistant Professor there during 1935-37, became Instructor in Physics at the University of Illinois in September, 1937, but withdrew in September, 1938, to become Head of the Department of Physics at Albion College.

George Kenneth Green (B.S. 1933, M.S. 1935, and Ph.D. 1937, University of Illinois) was appointed Instructor in Physics at the University for the academic year 1937-38 only. In June, 1938, he left to accept a National Research Fellowship at the University of California.

William Earl Shoupp (A.B. 1931, Miami University; A.M. 1933, and Ph.D. 1937 University of Illinois) served as Assistant in Physics from 1931 to 1937 and as Instructor in Physics here on an appointment for the school year 1937-38 only. At the end of that time, he left to engage in research at the Westinghouse Research Laboratory.

Morton Henry Kanner (B.S. 1936, Massachusetts Institute of Technology; Ph.D. 1940, Princeton University) began as Instructor in Physics in September, 1940, then received a leave of absence from November 7, 1940 to August 31, 1941 to serve in National Defense, but did not return to the University.

Russell DeWitt O'Neal (A.B. 1936, Depauw University: M.S. 1938, and Ph.D. 1941, University of Illinois) became Instructor in Physics at the University of Illinois in September, 1941 and has remained with the Department to date (1945).

Norman David Coggeshall (A.B. 1937, M.S. 1939, and Ph.D. 1942, University of Illinois) joined the Physics staff in September 1941, and remained with it until June, 1943.

Robert Douglas Rawcliffe (B.A. 1937, North Central College; M.S. 1939, and Ph.D. 1941, University of Illinois) served as Assistant in Physics at the

University here from 1937 to 1941. He became Instructor in 1941, but resigned in February 1942.

Jack Bruce Greene (A.B. 1937, Indiana University; M.S. 1940, and Ph.D. 1942, University of Pittsburgh) served as Instructor in Physics at the University of Illinois from September, 1941, to October, 1943.

Philip Morrison (B.Sc., 1936, Carnegie Institute of Technology: Ph.D. 1940, University of California) joined the staff here as Instructor in Physics in September, 1941, and remained here until February, 1943.

Martin Emmanuel Nelson (B.S. 1937, College of Puget Sound; M.S. 1939, University of Hawaii; and Ph.D., 1942, Ohio State University) came to the University in September, 1941, as Instructor in Physics, and remained on the staff until September, 1944.

William Elwood Ogle (A.B. 1940, University of Nevada; A.M. 1942 and Ph.D. 1944, University of Illinois) became Instructor in Physics at the University here in June, 1943.

Theodore Allen Welton (B.S. 1939, Massachusetts Institute of Technology; Ph.D. 1943, University of Illinois) began as Instructor in Physics here in June, 1943, and remained on the staff until September, 1944.

Martin Joseph Arvin (A.B. 1926, Indiana State Teachers College; M.S. 1930, and Ph.D. 1934, University of Illinois) was engaged in secondary-school work before joining the staff at the University of Illinois in September, 1943, as Instructor in Physics. He remained here until October, 1945.

George Curridan Baldwin (A.B. 1939, Kalamazoo College; M.A. 1941, and Ph.D. 1943, University of Illinois) became Instructor in Physics here in September, 1943, but resigned in September, 1944.

Carl Oliver Muehlhause (B.S. 1940, University of Virginia; M.S. 1941, and Ph.D. 1943, University of Illinois) joined the staff at the University here in September, 1943, as Instructor in Physics. He also resigned in September, 1944.

William David Rice (A.B. 1928, Asbury College; A.M. 1933, University of

Illinois) taught a number of years in secondary schools before coming to the University in September, 1943, as Instructor in Physics. He too withdrew in September, 1944.

Albert Jerold Hatch (B.S. in E.E. 1939, University of Illinois) became Lecture-Demonstrations Instructor in Physics here in September, 1943.

George Stanley Klaiber (B.A. 1938 and M.A. 1939, University of Buffalo; A.M. 1941, and Ph.D. 1943, University of Illinois) joined the staff as Instructor in Physics in September, 1943, and retained that position until September, 1944.

Scott Anderson (B.S. 1935, Illinois Wesleyan University; M.S. 1936, and Ph.D. 1940, University of Illinois), after some year's experience in teaching and in industry, served as Instructor in Physics here from November, 1944, until June, 1945.

Rosalyn Sussman Yalow (A.B. 1941, Hunter College of the City of New York; M.S. 1942, and Ph.D. 1945, University of Illinois) became Instructor in Physics in September, 1944.

Joseph Clare (M. Eng., 1905, University of Liverpool; B.D., 1911, University of London Hackney College) served as Instructor in Physics from January until October, 1945.

Barnard Herschel Crusinberry (B.S., 1932, Lewis Institute; M.S., 1942, Drake University) also served as Instructor in Physics from January until October, 1945.

Klaus Schocken, (Ph.D., 1928, University of Berlin) after some years experience in teaching in secondary schools in this country, became Instructor in Physics in October, 1945, in the ASTR Program.

H. SUMMARY

General - While the major portion of the instructional effort of the Department of Physics has been devoted to service for other departments and other colleges on the campus, the staff has been able to provide its own curricular program for undergraduate students and to offer training to a very substantial

list of graduate students that have gone out into academic and industrial positions.

In spite of the heavy demands imposed upon the staff by the instructional work, the members of the group have been able to carry on very substantial research projects that have produced far-reaching benefits towards the advancement of the field of physics. The inventions of the photo-electric cell and the betatron to say nothing of other developments that have contributed materially towards improvements in this science, have been among the most important in their day and have brought much credit to the Department in general and to the University in particular.

CHAPTER XII

THE DEPARTMENT OF MUNICIPAL AND SANITARY ENGINEERING

A. ORGANIZATION OF THE DEPARTMENT

General - The Department of Municipal and Sanitary Engineering was organized in 1890 -- about the time the applications of water-supply and sanitary engineering were receiving serious attention on the part of cities and towns that were urging the construction of better sewer, sanitary, and drainage facilities. Instruction in these subjects had been previously given by the Department of Civil Engineering, but it was believed that a formal curriculum for training city engineers would serve a public need and attract many students. This was probably the first curriculum to be established in a land-grant college in the United States offering organized instruction in municipal and sanitary engineering.

B. INSTRUCTION

Conduct of Instruction - The curriculum in Municipal and Sanitary Engineering, a modification of the one in Civil Engineering, was described in the 1894-95 Catalogue[1] as being "designed for students desiring to make a specialty of city engineering work. It prepares for the various duties of engineers of the departments of public works of cities and includes instruction in methods of sanitation of cities.

"Instruction is given by lectures, textbooks, and seminary work; by field laboratory, and drafting work. The methods of training are intended to develop power to take up and solve new problems connected with municipal works, as well as to design and superintend the ordinary constructions. Surveying, structural materials, and structural design are taught as in the civil engineering courses. The study of chemistry, botany, and bacteriology necessary to a comprehension of the questions involved in water-supply engineering and sewage disposal are given, and the facilities for this instruction are very good. The principles of the generation and transmission of electrical energy are given. Road engineering, water-supply engineering, and sewerage received special attention. A collection of drawings, plans, photographs, etc., has been added to the other equipment".

1 Page 53.

The curriculum is described in a later publication of the University issued in 1919 entitled "The College of Engineering and Engineering Experiment Station, a Pictorial Description,"[1] as offering "training in the design, construction, and operation of municipal public works, and considers generally the needs of city and community development.

"The Department is concerned with the solution of engineering problems affecting the public health and welfare, ~~as~~ the supply and distribution of potable waters, the construction of means for furnishing a water supply, including wells, impounding reservoirs, and lake intakes, and the building of water purification works, the disposal and treatment of the sewage of a city and the drainage of streets. Instruction is given in the design and construction of pavements, walks, bridges, viaducts, and the several means for providing for public safety and health".

C. ROOM ACCOMMODATIONS

General - The Department moved into quarters on the second floor of the west wing of Engineering Hall as soon as the building was completed in 1894. Its assignment included the departmental office,[2] a drafting room, a thesis room, and a seminary and lecture room. There was also a recitation room, an office and a computing room adjacent on the same floor for the work in theoretical and applied mechanics.

The Department had a large collection of plans, prints, specifications, reports, and photographs, covering municipal and sanitary-engineering subjects.

D. LABORATORY FACILITIES

General - The 1921-22 issue of The Register contained the following statement:[3] "The hydraulic laboratory is well equipped with apparatus illustrating the laws of hydraulics as applied in waterworks and sewerage practice, and it also contains a small rapid sand filter, a small slow aand filter, several arrangements of dosing siphons, a model of a water-purification plant and models illustrating the disposal of sewago by Imhoff tanks, sprinkling filters, and sand filters".

1 Page 12
2 Room 204
3 Page 131

Sanitary Engineering Laboratory, 1914-1926 - The original experimental sanitary laboratory constructed in 1914-15, was located in a small frame building that stood on University property east of Goodwin Avenue near the Boneyard between the Boneyard and the street railway tracks. In 1922, the plant was enlarged in accordance with plans providing for a cooperative research project between the Department of Municipal and Sanitary Engineering, the Department of Farm Mechanics, and the State Water Survey Division, to study methods of sewage disposal. The frame structure housed an elevated distribution tank, sedimentation tanks, dosing tanks, air and oxygen tanks, small septic tanks such as might be suitable for individual residences and small institutions, trickling filters, pumps and other devices, and chemicals needed for sewage and water analyses. Sewage was taken from the Champaign and Urbana outfall sewer and was returned to it after treatment.

The State Water Survey was especially interested in biological aspects of the activated sludge process and trickling filters, and also in the operation of the nidus tank. The Department of Farm Mechanics was interested in the small septic tanks, and the Department of Municipal and Sanitary Engineering in the distribution of sewage on and in trickling filters.

In 1924-25, the Chemical Foundation gave $1,000 from its receipts that had been collected from the use of the German patents on the Inhoff tank process, towards the study of sewage treatment at Illinois. The investigation was undertaken as a cooperative project between the Department of Municipal and Sanitary Engineering, the State Water Survey Division, and the Division of Sanitary Chemistry . The fund from the Chemical Foundation was placed under the control of the Division of Sanitary Chemistry.

When the Department of Municipal and Sanitary Engineering was discontinued in 1926, the work of the Sanitary Engineering Laboratory was transferred to the Department of Civil Engineering.

E. FACULTY PERSONNEL

a. Head of the Department

General - Arthur Newell Talbot served as Head of the Department of Municipal

and Sanitary Engineering from its inception in 1890 to its close in 1926. A portion of Professor Talbot's biographical sketch appears below.

Arthur Newell Talbot was born at Cortland, Illinois, on October 21, 1857, and was graduated from the civil-engineering curriculum at the University of Illinois in 1881. As a student young Talbot was noted for thoroughness of scholarship, breadth of interests, steadiness of purpose, and maturity of judgement. The average grade of his undergraduate studies was 98 -- an achievement that remained the record for many years.

The student Talbot did not devote all of his time and energy to study, however, but was active in extra-curricular activities. As the literary society was the chief source of interest outside of the classroom program during the days when he was a student, he took a prominent part in the affairs of the Philomathean organization. He must have been a guiding spirit in the institution, for he became in turn Secretary, Vice-President, and President of that organization. He served as delegate to the Interstate Oratorical Association, as Class Essayist, and for a year as Associate Engineering Editor of the Illini. It cannot be doubted that his interest in student literary activities and the training he received in that connection, helped to develop the precision and clearness in speech and writing which became one of his outstanding characteristics. He served also as a leader in student government and as a ranking officer in the Cadet Corps. In addition to these activities, he gave instruction in preparatory mathematics and in his senior year, was a student assistant in Physics.

After graduation he was engaged for four years in railroad surveying, construction, and maintenance of way in the West; and in June, 1885, for his practical experience and the preparation of a thesis, he was granted the degree of Civil Engineer. It was then that he became a member of the Department of of Civil Engineering. He remained with this Department until June 1890, when he became Professor of Municipal and Sanitary Engineering. At that time also, he was formally placed in charge of the Department of Theoretical and Applied Mechanics although for several years he had practically directed that work, and had already

inaugurated laboratory practice in materials testing and hydraulics. During the 1890's, although seriously hampered by lack of money and suitable space, he gradually developed his work to a high degree of efficiency; and this did much to advance the status of the entire College, since all engineering students took mechanics and most of them hydraulics.

Before the turn of the century, Professor Talbot had made contributions to the engineering profession in a number of fields which brought distinction to him and the College of Engineering. One of these earliest was a formula for areas of waterways for bridges and culverts, which was first published in 1887-88 in "Selected Papers of the Civil Engineers' Club," -- an organization that later became The Technograph. Another was a formula for rates of maximum rainfall. This was also published in an early issue of The Technograph. Both formulas have been often quoted and widely used and bear his name today. A small treatise on a very flexible method for laying out easement spirals at the ends of circular curves (first described by him in Volume 5 of The Technograph issued in 1890-91) was published in 1899 as "The Railway Transition Spiral". It has gone through several editions and has been used by many railroads. His pioneer work in sewage treatment by means of septic tanks later made it possible for municipalities to contest certain patent claims on methods and principles of sewage disposal. During this period his investigations provided standard tests of paving brick for strength and abrasion. Before the age of forty he had made important contributions in hydrology, railway engineering, sanitary engineering, and testing materials. After the era of expansion in engineering schools began, mechanics and engineering materials absorbed the attention of Professor Talbot even more than sanitary engineering; and without a change in title, the emphasis of his work swung to the field of theoretical and applied mechanics.[1]

b. Other Professors

Harold Eton Babbitt-See Civil Engineering, Chapter VIII

c. Associates

Roy Harley Slocum (B.S. in C.E. 1900, and C.E. 1910, University of Illinois)

1 The remainder of Professor Talbot's biography appears under Theoretical and Applied Mechanics.

served as Assistant in the Department of Theoretical and Applied Mechanics during 1901-02 and Instructor during 1902-05. He became Instructor in Municipal and Sanitary Engineering in 1905 and Associate in 1906. He withdrew in 1907 to become Professor of Civil Engineering at North Dakota Agricultural College -- a position he has held to date.

George Conrad Habermeyer (B.S. in C.E. 1903, University of Illinois) was employed in engineering practice for four years after graduation, then in September 1907, joined the College staff here as Instructor in Municipal and Sanitary Engineering. He became Associate in 1909, and remained with the Department until 1913, when he resigned to re-enter engineering practice. In 1916, he became connected with the State Water Survey Division and continued with it until 1928, serving during 1918-19 as Acting Chief.

Paul Hansen (B.S. in Sanitary Engineering, 1903, Massachusetts Institute of Technology) was engaged in public-health engineering for several years after graduation. He became Chief Engineer for the Illinois State Water Survey and Associate in Municipal and Sanitary Engineering at the University here in 1911. He resigned this position in 1915 to become Chief Engineer of the Illinois State Department of Health at Springfield. From 1920 until his death on February 6, 1944, he was a member of the firm of Pearse, Greely, and Hansen (later Greely and Hansen) Consulting Engineers.

d. Instructors

Roy Victor Engstrom - See Theoretical and Applied Mechanics, Chapter XII.

Harvey Ellison Murdock (B.S. in M.E. 1906, M.E. 1908, and C.E. 1911, University of Colorado) served as Instructor in Municipal and Sanitary Engineering here from 1906 to 1909, and in Theoretical and Applied Mechanics from 1909 to September, 1912, after which he became interested in irrigation work in the West. Mr. Murdock was author of a textbook entitled "Strength of Materials".

F. THE DEPARTMENT DISCONTINUED

General - Due to one cause or another, the curriculum in Municipal and Sanitary Engineering never attracted any considerable number of students. The reason

for this is not clear. Certainly the content of the curriculum and the instruction were not inferior to those of other more popular curricula in the College. Possibly the small registration was due in some measure to the usual uncertainty of tenure of office of city engineers.

At the time Professor Talbot was retired from teaching and administrative duties, on September 1, 1926, the Department was discontinued and the work was transferred to the Department of Civil Engineering, which offered a new option in Sanitary Engineering to provide for instruction in water supply, sewage disposal, and hydraulic engineering. This option is described in some detail in a later chapter.

CHAPTER XIII

THE DEPARTMENT OF THEORETICAL AND APPLIED MECHANICS

A. ORGANIZATION OF THE DEPARTMENT

General - It was recognized at an early date in the history of the University that all students should have instruction in mechanics, the science that deals with the forces and deformations which must be considered in the design and construction of bridges, buildings, machines, and other engineering structures, the materials of engineering, and the motions set up in machines. It was also recognized that there should also be instruction in hydraulics, which deals with the flow of water through pipes, canals, channels, and conduits, and the problems to be solved in the development of water power. Accordingly, some work, although not designated by the name mechanics, was offered in the 1870's; but about 1885, Professor Talbot, who for long years afterwards was Head of the Department, initiated some organized instruction in engineering materials.

The Department of Theoretical and Applied Mechanics was made a separate organization though in 1890, by combining instruction in mechanics for all engineering students into one service department. This plan, which has become common in most of the engineering schools, ~~has become common in most of the engineering schools~~, has proved to an advantageous arrangement for it has created interest in the particular fields of its divisions, has fostered proficiency in instructional methods, and has stimulated effort in analytical and experimental research.

B. INSTRUCTION

General - In the University Catalogue and Circular of 1894-95,[1] when the Department of Theoretical and Applied Mechanics was first mentioned as a separate department, this statement appeared: "The courses in theoretical and applied mechanics are designed to meet the need of students in the College of Engineering. Training is given in the principles of the subject and in the application and methods used in engineering design and construction. The textbook work is supplemented by lectures and reading. Stress is placed on the solution of engineering problems involving discrimination in the use of data and in the statement of conditions. Experimental work and investigations in the laboratory of

[1] Page 56.

applied mechanics is a part of the regular instruction. Opportunity is also given for advanced laboratory investigation for thesis and special work".

While the Department has no curriculum and does not grant baccaulaureate degrees as most of the other departments do, it does act as a service department to give instruction in analytical mechanics, mechanics of materials, and hydraulics, not only to students of all the other departments of the College of Engineering, but also to students in the College of Liberal Arts and Sciences and in the College of Commerce -- all students in Chemical Engineering and Industrial Administration being required to register in some courses in this particular field of engineering. In addition, the Department has many students registered in advanced courses looking towards the M.S. and Ph.D. degrees.

In a publication entitled "The Function of the Laboratory in Engineering Education," John Sanford Peck brought together[1] a number of statements made by various instructors concerning the objectives to be attained by laboratory instruction in mechanics, from which the following have been selected:

"Boomsliter, in 1930, published the most comprehensive study of the work of the materials testing laboratory that had been made up to that time. He listed seven objectives, with the comment that the emphasis on them varied widely in different schools. These objectives were:

1. To give the student first-hand knowledge of the behavior of materials.
2. To acquaint him with the various types of testing apparatus and their operation.
3. Drill in the standard tests of materials.
4. To enable him to make intelligent selection of materials for various purposes.
5. To show the effects of alloys and variations in quality on the various properties of materials.
6. Drill in curve plotting and the interpretation of curves.
7. Drill in report writing.

"Boomsliter also listed four additional objectives which he credited to H. F. Moore, Research Professor of Engineering Materials at the University of Illinois. They were:

1. A study of the laws of mechanics of materials.
2. A study of the basic properties of materials of construction.

1 1936, pages 14-15.

3. Training in the technique of handling testing apparatus.

4. Secondary purposes:

 a. The presenting of contact between college and industry.
 b. Development in the student of an appreciation of the proper degree of accuracy and sensitivity in experimental work.
 c. Study of the mechanical substitutes for mathematical analysis.

"According to Boomsliter, Moore held that some laboratories were used entirely for the second purpose while others combined one and two from his list.

"The latest contribution was made by Draffin in 1932. He stressed these objectives:

1. To teach the student to observe the behavior of a typical material, such as wood, or steel, under a given type of loading.

2. To relate the action under load with the mathematical analysis which he has studied in the classroom.

3. To draw a conclusion from his work.

"Of this last objective, Draffin has this to say:

'This last is one of the most important and educational parts of the exercise - the student has done a piece of work and he is now asked to evaluate it. Perhaps the conclusions which should be drawn are obvious, but it is surprising how many obvious things are unseen or not considered important until one is trained to look for them'".

Further mention regarding instruction in Theoretical and Applied Mechanics is made as follows in a 1940 publication of the College of Engineering:

"Courses in theoretical and applied mechanics are required in all the engineering curricula. The purpose of the courses is to teach the student to analyze and solve engineering problems by applying the principles of mathematics and of physics to conditions as they arise in the design, construction, and operation of engineering structures and machines. In the well-equipped laboratories, the student tests many engineering materials, such as steel, brass, aluminum, timber, and concrete, to determine the various properties that are needed in the use of the materials in design and construction, and in the writing of specifications for the materials. In the hydraulics laboratory, he performs experiments on the flow of water in pipes and open channels, and determines the operating characteristics of different kinds of pumps and turbines. A number of advanced courses in the analysis of stresses in materials, in testing of materials, and in hydraulics are offered, which may be elected by junior and senior students. A large amount of research work is carried out in the laboratories, some of which involve tests of large members. Students are encouraged to follow the progress of this investigational work."[1]

<u>Undergraduate Registration in T.& A.M. Courses, 1911-1944</u> - The following figures in Table XIX give the total registration by years of undergraduate students in the various courses offered by the Department of Theoretical and Applied

1 University of Illinois Bulletin, Vol.XXXVIII, October 29, 1940, No.10, page 17.

Mechanics:

TABLE XIX-UNDERGRADUATE REGISTRATION IN COURSES IN THEORETICAL AND APPLIED MECHANICS, 1911-1944

1911-12	1579
1912-13	1759
13-14	1750
14-15	1287
15-16	1297
16-17	1229
17-18	899
18-19	767
19-20	1370
20-21	1352
21-22	1379
22-23	1197
23-24	1158
24-25	1081
25-26	1163
26-27	1344
27-28	1364
28-29	1408
29-30	1400
30-31[1]	2185
31-32	2382
32-33	1902
33-34	1595
34-35	1613
35-36	1682
36-37	1921
37-38	2413
38-39	2680
39-40	2660
40-41	2553
41-42	2463
42-43	2135
43-44	2269

Comparison of figures after 1930-31 with thoseof preceding years is difficult because of the renumbering of courses and the changes in course arrangement made at that time. The peak of enrollment for the thirty-three year period, no doubt, was reached in 1938-39 though when the registration totalled 2,680.

C. BUILDING AND ROOM ACCOMMODATIONS

General - The laboratory of applied mechanics, first mentioned as such in the 1893-94 issue of the University Catalogue and Circular, was located principally on the first floor of Machinery Hall (old Mechanical Building and Drill Hall). After this building and its contents were almost entirely destroyed by fire in 1900, a new structure called the Laboratory of Applied Mechanics, was erected in 1902, that was

1 Courses renumbered.

devoted entirely to mechanics and hydraulics. The two-story front of this building was used for mechanics -- the first floor being given over to laboratory work and the upper floor being used for offices and computing rooms. The one-story rear portion was fitted up for a hydraulic laboratory. The Department continued to use some class rooms and offices in Engineering Hall, and in addition, it took over in 1906 the west end of the north bay added to the Mechanical Engineering Laboratory for experimental work in reinforced concrete. It transferred its equipment from this location to the northeast room of the basement and first floor of the Ceramics Building when that structure was completed in 1916. Furthermore, in 1919, the Department arranged the upper room at the north end of the old Boneyard heating plant for a fatigue-of-metals laboratory. However, all of these experimental laboratories were transferred to the New Materials Testing Laboratory (later called the Arthur Newell Talbot Laboratory) when that building was completed in 1929.

D. DEVELOPMENT OF LABORATORY FACILITIES IN THEORETICAL AND APPLIED MECHANICS

Materials Testing Laboratory, 1868-1902 - The College of Engineering had been established twenty years before it offered any systematic engineering laboratory work, although in the early 1870's Professor Robinson in giving instruction in Physics, so enthused his students in resistance of materials and hydraulics that they built apparatus with their own hands that they might conduct experiments. For example, they made two pieces of apparatus for testing the flexure of wooden "beams" (sticks one to one and one-half inches square and twenty-four to thirty inches long), and another piece of apparatus for determining the elongation of wires.

Though compelled to pump the water from a well and carry it up a flight of stairs, students in the class in hydraulics made two tanks and conducted experiments in the flow of water through a variety of orifices. These two series of experiments occupied many afternoons and Saturdays of most of the members of these classes. They showed commendable inventive ability and a surprising degree of accuracy, and gave valuable training in interpreting observed results and in

eliminating sources of error. All three sets of apparatus were afterwards used for several years in the classes in physics laboratory practice.

More extended instruction in applied mechanics and hydraulics began about 1877 under Professor Robinson with such improvised equipment and apparatus as he could provide from his own resources. When Professor Talbot began to teach Resistance of Materials in 1885, he introduced the use of a small home-made beam-testing machine for showing the agreement between the computed and observed deflection of several forms of beams. In 1887, he received an extensometer for use in class instruction. Some of the work done by students with these two machines was exhibited at the World's Columbian Exposition in Chicago in 1893.

As illustrating one of the difficulties of securing laboratory apparatus, the following may be cited. One of the engineering professors upon going to the Regent and urging the desirability of the University securing a materials testing machine, was told rather sharply that it was "the function of a teacher to stand part way up the mount of knowledge and hand down information to those below". However, late in the same year, 1887, the Regent apparently without further urging or even request, bought a 100,000-pound Riehle materials testing machine[1] which was installed early in 1888 and put to use in instruction and investigation. The first use of this machine was by Professor Baker in investigations in connection with the first edition of his book on "Masonry Construction" then in preparation; and the first class instruction with this machine was by Professor Talbot on February 25, 1888.

The 1891-92 Catalogue and Circular[2] made mention of the Testing Laboratory as follows: "The testing laboratory has a Riehle Testing machine of 100,000-pound capacity, a smaller apparatus for testing beams, a Riehle cement testing machine, a stone grinder for preparing test pieces of stone, a rattler for abrasion tests of stone and brick, with other apparatus for making all necessary measurements and observations, molds, standard sieves for cement, etc. The laboratory is fitted up as a working laboratory where students may acquire such practice in

1 Price at factory $1100
2 Page 41.

experimental work as engineers are called upon to perform, as well as for the purpose of illustrating principles as for use in original investigations. The ordinary work includes testing metal, wooden beams, cement briquettes, and stone and brick".

The 1892-93 Catalogue and Circular stated[1] "The testing laboratory located in Machinery Hall, gives opportunities to students of the College of Engineering to make various practical experiments and tests, and to prosecute original investigations in the lines of their specialties".

In 1893, the legislative appropriations were sufficient to allow the Board of Trustees on July 6, 1893, at their first meeting after the passage of the bill to grant to Professor Talbot an amount of $1,700 for the materials testing laboratory. With this money, there was added in 1894 a Tinius Olsen testing machine[2] arranged for tension, compression, and cross-bending tests, with a capacity of 100,000 pounds for beam loading and 200,000 pounds for center loading, the machine taking beams up to 20 feet in length. By that time, the laboratory was fairly well equipped, for it had already acquired a 100,000 pound Riehle testing machine, as previously stated, an Olsen cement testing machine, and a machine for testing small beams. There was added within the next two years or so a 10,000-pound Riehle wire testing machine, a large collection of extensometers, deflectometers, scales, micrometers, calipers, and other measuring devices. A little later, there was added several smaller testing machines, and apparatus for testing wood in shear, and for determining the shearing strength of rivets and the strength of riveted joints. There were also devices for holding and testing cables and a variety of different forms of test pieces and test structures. By 1900, the equipment of the laboratory was brought up to be, in variety and completeness, as good or better than that in any other, except perhaps two, of the engineering schools of the country. During this period the laboratory methods of instruction were developed and perfected to be second to none.

In this laboratory some excellent thesis work was done which gave new information of value -- tests of large size timber beams, tests of riveted joints,

1 Page 25
2 Cost at factory $1,550.

tests of shearing strength of rivets, impact tests of wooden beams, etc. The most noted of these was an investigation made in 1896 on the method of testing brick by means of the rattler. This investigation proved to have a marked effect upon testing methods and engineering practices. The use of brick for paving was comparatively new, and the testing of paving brick was in a very confused state. The National Brick Manufacturers' Association had recently completed an elaborate series of experiments and proposed a standard method of testing paving brick which had been widely adopted. Mr. Henry J. Burt, C.E. '96 as his graduating thesis under the direction of Professor Talbot, made a series of tests on paving brick and secured results which afterwards enabled Professor Talbot to convince the parties interested of the need of making radical changes in the then standard method of testing paving brick. Thereafter, the method developed by Professor Talbot and Mr. Burt became the accepted standard.

In June 1900, the building housing the laboratory was burned and practically all of the equipment was severly damaged or destroyed.[1] During the year following very little work could be offered in materials testing. What little that was done along that line, was carried on in a room on the ground floor of the

---

1 "The first large-sized testing machine bought by the laboratory was a Riehle 100,000-pound machine operated by a hydraulic cylinder with the load measured by compound levers and a moving poise. In the Inventory Record this machine is marked 'Destroyed in the Fire of 1900'. However, only the poise and the scale beam were destroyed. The remainder of the machine was stored in the basement of the old T.& A.M. building until about 1910 or 1911, when I designed a pendulum weighing device, had it built in the old T.& A.M. shop, and put on the machine and calibrated. A small hydraulic pump was bought for the machine, and the machine itself was used for five or six years. The apparatus was eventually loaned to another department for some special tests, it was overloaded, and the main levers broken. The hydraulic cylinder of the machine is now stored under the Engineering Building.

"The 200,000-pound Olsen machine now in the Talbot Laboratory was injured in the fire of 1900. I do not know how badly it was damaged, but in 1902 it was repaired and used by Professor Talbot on his first series of tests of reinforced concrete beams. It has been in use ever since. It has not been calibrated for some years, but when last calibrated was found to have a good accuracy, but a rather low sensitivity on account of the blunted knife edges.

"In the Inventory Record there is also a designation of the 10,000-pound wire testing machine which is marked as 'Destroyed by the Fire of 1900'. I have never seen any 'remains' of that machine, so I take it that one was destroyed.

"A large number of pieces of auxiliary apparatus and some strain-measuring equipment were also destroyed in the fire of 1900". - Letter from Professor H. F. Moore dated November 6, 1943.

Mechanical and Electrical Engineering Laboratory.

Materials Testing Laboratories, 1902-1929 - The materials testing laboratory of the Department of Theoretical and Applied Mechanics occupied the new Laboratory of Applied Mechanics completed in 1902. Under the direction of Professor Talbot, the equipment was extended as rapidly as possible, and there was soon assembled machines for class room and experimental use in testing specimens for tension, compression, flexure, torsion, and impact. The most noteworthy pieces of apparatus included the 100,000-200,000-pound capacity Olsen machine obtained in 1894 as previously mentioned; a 100,000-pound, 2-screw machine, obtained from the Philadelphia Machine Tool Company in 1902; a 230,000-inch-pound Olsen torsion machine obtained in 1902; a 10,000-pound long beam type of hand-power Riehle machine obtained in 1903; a 100,000-pound, 2-screw, Riehle testing machine with autographic recorder, received in 1904; and a vertical testing machine of a new type that had a capacity of 600,000 pounds. This last-named machine at the time of its construction, was one of the largest in any laboratory devoted to educational purposes, and is described in some detail in the following paragraphs.

"During the first half of the year 1905, there was installed in the Laboratory of Applied Mechanics a 600,000-pound testing machine[1] of the vertical screw type. It was the largest vertical screw machine that had been built up to that time and had many novel features in the design. Coupled with its large capacity was an unusual distance between screws and a height which admitted of very long and bulky specimens. Among the novel features were guide columns to take the thrust due to eccentric loads, recoil cylinders to lessen the blow on the knife edges when the load was suddenly released by the breaking of the specimen, double-webbed levers to distribute the load more evenly over the knife edges, and a new style of poise arrangement.

"The machine was built by the Riehle Bros.Testing Machine Company of Philadelphia in accordance with designs furnished by the Department. It was a universal testing machine and was designed for tests in tension, compression, and cross-bending. It was intended to take columns, long test pieces, beams, large irregular shapes, reinforced concrete, stone and brick construction, built-up metal trusses, and a great variety of other forms of test pieces.

"The vertical type was necessitated by the fact that with specimens of any considerable length in a horizontal position it is impossible to determine with accuracy the increase in stress due to the weight of the specimen, itself, and this is especially true of such materials as concrete and reinforced concrete.

"The machine rested on a bed of concrete four feet thick. The Irving gears and levers were below the floor level, which was level with the top of the

1 "The 600-000-pound Testing Machine," by F.A.Randall, in Technograph, 1904-05, No. 19, page 103-108.

weighing table.

"The dimensions of the machine were:

Extreme height	30 feet 8 inches
Extreme length, including motor	17 feet 0 inches
Extreme width	10 feet 8 inches
Distance between screws	3 feet 0 inches
Height above floor	30 feet 8 inches
Weight	130,000 pounds

"The machine could take compression members 25 feet long. It could handle tension specimens 22 feet long with 20% elongation in 20 feet. The grips could take pieces 6 inches round or square to 3/4 inch round or square, and specimens 12 inches by 4 inches or less. It could take transverse pieces 10 feet by 3 feet wide. By means of an I-beam extension to the weighing table, the length of the specimen in transverse test could be 25 feet.

"The machine was built especially for the University in connection with the Engineering Experiment Station, but was also used for instructional purposes".

During 1905, there was received also a 100,000-pound Olsen, 3-screw universal testing machine, and in 1906, a 10,000-pound capacity hand-power Olsen machine. There were obtained, in addition, during these years, a number of extensometers and auxiliary pieces of apparatus, many of which were designed by members of the Department. In 1906, when the north bay of the Mechanical Engineering Laboratory was completed and additional space was provided at the west end of it for making, storing, and testing concrete test specimens, there was installed there a compression machine made up of four hydraulic jacks and pumps having a total capacity of about 800,000 pounds for conducting experiments involving the use of external pressure on large rings, such as 48-inch by 100-inch culvert pipes, embedded in sand. In 1907, there was installed in the main laboratory a 10,000-pound Olsen hand-operated 4-screw, universal machine; and during 1907-08, there were provided a 100,000-pound, 2-screw Riehle machine, and a Purdue type of impact machine made by the Mechanical Engineering Department of Purdue University. In 1910, there were added a 100,000-pound, 2-screw Riehle machine, and a 10,000 inch-pound Riehle torsion machine; while in 1912, there was procured a 50,000-pound, 2-screw Riehle machine with autographic recorder.

When the Ceramics Building was completed in 1916, a large double story room extending from the basement floor to the ceiling of the main floor in the north-east corner of the building was assigned to the Department of Theoretical and

Applied Mechanics for research work in concrete and reinforced concrete. A new 300,000-pound Olsen testing machine was installed there and remained there until the new Materials Testing Laboratory was completed in 1929.

A new Olsen testing machine of 100,000-pound capacity was added to the equipment of the Department during the summer of 1920. The machine was of three-screw type and was independently driven by a reversible electric motor through a system of spur reduction gears. Four speeds were provided for running the head in each direction. There was installed, also at that time, a 10,000-inch-pound Riehle torsion machine, a 10,000-pound Olsen hand-power beam testing machine, and a 10,000-pound Riehle hand-power beam testing machine. A 50,000-pound Riehle compression machine for testing mortar specimens and a Henry L. Scott and Company machine of 1,000 pounds capacity for testing wire and flat metal specimens were added in 1921-22. During 1923-24, a 250-pound Henry L. Scott and Company vertical machine was installed for testing rubber, fabrics, and so on.

A new 100,000-pound testing machine made by Amsler at Schaffhausen, Switzerland, was delivered in 1925-26. It represented the best European practice in testing machines and was regarded by Professor Talbot as in some ways the best testing machine built. It was especially adapted to rapid and accurate testing.

Beggs deformeters and a Rockwell hardness tester were added in 1924-25, and a new 200,000-pound Riehle testing machine was installed in 1927. In addition, during 1927-28, there was provided a 5,000-pound Riehle motor-driven transverse testing machine equipped with an autographic attachment. Additional equipment acquired in 1928 included an Olsen wire testing machine of 1,000 pounds capacity and a 50,000-pound Riehle, 3-screw, testing machine, fitted with a large table and high head.

Materials Testing Laboratories 1927-1945 - When the new Materials Testing Laboratory Building, now the Arthur Newell Talbot Laboratory, was completed in 1929, the testing equipment used for instructional purposes was moved from the old Laboratory of Applied Mechanics into two large rooms on the third floor of the new building. New machines were added as funds permitted, so that 1945, the

south room of the two contains the following equipment, mostly small-capacity machines; practically all of which have been mentioned in previous sections; two hand-power Riehle 10,000-inch-pound torsion machines, one procured in 1910 and one in 1920; two 5,000 inch-pound hand-power torsion testing machines designed by H. F. Moore and built by the J.W.Hayes Company of Urbana in 1931; two Olsen hand-power beam-testing machines of 10,000 pounds capacity, one bought in 1906 and one in 1920; two Henry L.Scott and Company tensile testing machines, one of 1,000 pounds capacity purchased in 1922 and one of 250 pounds capacity procured in 1923-24; two Riehle hand-power beam testing machines of 10,000 pounds capacity, one obtained in 1903 and one in 1920; one Olsen Izod hand-power impact machine of 10 foot-pound capacity purchased in 1928; one Olsen, 3-screw testing machine with dial indicator and autographic recording device, of 50,000-pound capacity, secured in 1938; one hand-operated 10,000-pound Olsen testing machine made with four small screws, obtained in 1907; and one fatigue-of-metals machine and one testing machine built by the University.

In 1945, the north room of the Materials Testing Laboratory on the same floor contains the following equipment: One 100,000-pound 2-screw, testing machine secured from the Philadelphia Machine Tool Company in 1902; one 100,000-pound Riehle 2-screw machine with autographic recorder purchased in 1904; one 100,000-pound, 3-screw testing machine obtained in 1905; one 100,000-pound 2-screw Riehle machine purchased in 1907; one 100,000-pound 2-screw Riehle machine received in 1910; one Riehle 50,000-pound 2-screw machine with autographic recorder obtained in 1912; one 100,000-pound 3-screw Olsen machine obtained in 1920; one 50,000-pound 3-screw machine purchased in 1928; one 5,000-pound Riehle beam machine with autographic recorder, procured in 1928; and one 60,000-pound, 2-screw, Southwark-Emery hydraulic type obtained in 1932 and installed in the space formerly occupied by the 200,000-pound Riehle machine which was obtained in 1927 and which had been transferred to the large crane bay on the first floor.

The equipment in this room as well as that described in the preceding paragraph, is regularly devoted to instructional purposes and has been the means for enabling students to acquire some proficiency in the handling of testing machines and in obtaining thereby a working knowledge of their operating characteristics, and in the examination of the materials of construction ordinarily employed in

engineering practice; when it is not so engaged, however, it is frequently used for experimental service.

Concrete Research Laboratories 1929-1945 - When the new Materials Testing Laboratory, now the Arthur Newell Talbot Laboratory, was completed in 1929, the apparatus used by the Departments of Theoretical and Applied Mechanics and Civil Engineering for materials testing was transferred to this new building. The concrete laboratory used for research purposes occupies the southeast wing of the ground floor of the building and the east end of the small crane bay, and is under the direction of Professor F.E. Richart. This space provides storage for concrete materials and reinforcing steel, concrete mixers, a concrete saw, a core drill, and other tools and equipment used in fabricating and testing members built of plain and reinforced concrete. There are large moisture rooms fitted with temperature control to cure test specimens under standard conditions. The small bay is equipped with a 300,000-pound Olsen[1] universal testing machine with a 22-foot table, used for testing reinforced concrete beams and slabs, and with a 6-ton overhead traveling crane to facilitate the handling of test specimens.

Engineering Materials Laboratory 1929-1945-The engineering materials research laboratory, shared with the Department of Civil Engineering as previously stated, occupies all of the large crane bay and is designed primarily to study the behavior of large specimens of wood, metal, and reinforced concrete under various systems and conditions of loading. The large crane bay is equipped with a number of heavy testing machines for examining large structural members under something like service conditions. The largest of these is the 3,000,000-pound capacity machine described in some detail in the following statements summarized from an article in The Technograph by Professor Wilbur M.Wilson entitled "The 3,000,000-Pound Testing Machine of the Materials Testing Laboratory".[2]

A new testing machine having a capacity of 3,000,000 pounds in either tension or compression was installed in the Materials Testing Laboratory, now the Arthur Newell Talbot Laboratory, in 1929-30. The machine was built and erected by the

1 This is the machine which was installed in the Ceramics Building by Professor Talbot in 1916.
2 May, 1930, pages 153-154

Southwark Foundry and Machine Company of Philadelphia, under a license issued from the Emery-Tatnall Company. The operation of the mechanism is partly mechanical and partly hydraulic. The equipment is used jointly by the Departments of Theoretical and Applied Mechanics and Civil Engineering for work in research involving heavy loadings. It is located on the ground floor of the large crane bay, and occupies the full height of the building, extending 49 feet 6 inches above the floor line and 15 feet below that level. The maximum clear height from the bottom of the compression head to the top of the bed of the machine is 38 feet 6 inches. The clear distance between screws is 7 feet 6 inches.

The main screws, which are steel forgings, have a total length of 57 feet 8 inches, an outside diameter of 12 inches, and weigh 11 tons. Acting as tension members, the screws resist the full capacity of the machine, 3,000,000 pounds. The screws do not turn when being loaded and therefore are not subjected to combined tension and torque. These screws, operated by means of a 50-horsepower motor, move the pulling head at a speed of 2 feet a minute. The load delivered to the specimen under investigation is measured by means of the Emery Hydraulic support built into the pulling head. This support consists essentially of a reinforced diaphragm whose area subjected to oil pressure is definite and known. The resistance of the specimen produces a pressure in the oil, which is measured by means of an electric autographic recording mechanism and also by means of three Emery precision gages having capacities of 200,000, 1,000,000, and 3,000,000 pounds respectively --the small gages being provided to give a greater sensitivity at small loads. The pressure of the oil in the cylinder when the machine is working to full capacity is approximately 1,800 pounds a square inch. The pressure is developed by means of a Hele-Shaw pump directly connected to a 15-horsepower motor having a speed of 1,500 r.p.m. By means of an automatic regulator, the load can be maintained constant for a period of several hours.

The machine is used for testing full-size steel and concrete columns, masonry piers, steel cables, riveted and welded joints, eye-bars, car couplers, chord members of bridges, cast iron and steel pipe, and other heavy structural materials.

This large crane bay also houses the previously-described 600,000-pound testing machine transferred from the laboratory of Applied Mechanics to the new location when the building was completed in 1929. It houses, in addition, the 300,000-pound Riehle universal testing machine purchased in 1923, which is capable of handling a 20-foot beam, column, or tension member, and which was formerly located in the old Boneyard Boiler House after a portion of it had been remodelled for a structural laboratory. Besides these, there is the 230,000-inch pound Olsen torsion machine obtained in 1902; the 200,000-pound Riehle testing machine which was transferred from the north room of the Materials Testing Laboratory in 1932; the Olsen testing machine having a capacity of 100,000 pounds for beam loading and 200,000 pounds for center loading, which was obtained in 1894; a Riehle 30,000-pound, 3-screw machine with autographic attachment, purchased in 1924; a Riehle 3,000-kilogram Brinell hardness testing machine obtained in 1924; and the Purdue impact machine secured in 1907-08. All of these machines except the Brinell instrument were mentioned in previous statements.

The many tests that have been run with the machines in this laboratory have provided a great mass of data used as basis for the publication of a long list of bulletins by the Engineering Experiment Station that have served to clear up many of the problems relating to the design and construction of machines, structures, and other fabrications made up of iron, steel, concrete and reinforced concrete, timber, and other types of engineering materials.

Fatigue-of-Metals Laboratories - Work in the fatigue of metals, devoted to a study of the behavior of metals under action of repeated loadings, was started in 1919 by Professor H. F. Moore in a laboratory provided in the north end of the second floor of the old Boneyard Boiler House, which was later named the Electrical Engineering Annex. Various types of machines were set up in this room and were kept there until the new Materials Testing Laboratory was completed in 1929. Then, the equipment was transferred to the northwest room on the top floor of this new structure, and was composed of the following items: Twenty-one rotating-beam machines, three of them large size, and one capable of testing car-axle specimens 2 inches in diameter; three machines for testing metals under

repeated twisting stress; three machines for testing metals under repeated tensile loading; two machines for testing sheet metal under repeated bending, three of which were arranged to test the metal at elevated temperatures. Many of those machines were designed by the laboratory staff and were constructed in the laboratory shop.

New apparatus was added from time to time as funds were available. The following description in The Technograph[1] gives some idea of the facilities on hand in 1938.

"The Fatigue of Metals Laboratory is one of the most completely equipped in any college in the country. There are over 40 machines varying from small rotating beam machines which take a 3/16 inch specimen and run at 10,000 r.p.m. to rotating beam machines turning a 2-inch in diameter specimen at 1,000 r.p.m.

"The most numerous of the many types of machines in the laboratory are the rotating-beam machines, the simple-beam machines with constant bending moments and the smaller, faster cantilever beam machines. There are special machines for repeated torsion and repeated tension-compression, as well as special machines for conducting tests at temperatures 1,200 degrees F. Some of the fatigue machines have attachments for investigations of the simultaneous effects of corrosion and fatigue.

"The fatigue specimens operate 24 hours a day every day in the year. Fatigue specimens usually have to run 10,000,000 cycles and often as much as 100,000,000 cycles. Some specimens have been run continuously for over a year in the laboratory with as many as 1,000,000,000 cycles".

Most of these machines are still in use in 1945 and still others have been added. Besides, there is the 100,000-pound Amsler testing machine, procured in 1925-26, as previously mentioned, a machine designed in the laboratory for testing sheet metal, and a number of machines for hardness and impact tests of metals. There is also a gas furnace for heat-treating and case-carburizing and nitriding of specimens.

Creep-in-Lead Laboratories - Several rooms in the east wing on the top floor of the Arthur Newell Talbot Laboratory have been occupied since 1929 for investigational work directed by Professor Moore, involving creep-in-lead and lead-alloy specimens under conditions in some cases of continuous tension maintained by suspended weights, in other cases of repeated loadings, and in still other cases of constant internal pressure. Some of the apparatus is constructed and arranged to carry on studies of creep in lead at elevated temperatures.

1 March, 1938

Rails-Investigation Laboratory - The laboratory tests on rails conducted on the main floor and top floors of the Arthur Newell Talbot Laboratory, under the direction of Professor Moore, have included work for the study of transverse fissures in steel rails and of the different forms of welded rail joints. The equipment consists of machines for applying repeated rolling loads to rails and for applying, bending, impact, and other tests to determine the mechanical properties of rails and rail welds, and of facilities for examining the chemical composition and the metallographic structure of steel specimens. The apparatus includes a Leitz metallographic microscope capable of taking pictures with magnifications of 10 to 14,000; a 6-volt, 2000-ampere, direct-current motor-generator set, a grinder; two rail-testing machines; strain gages; and so on.

Brake-Shoe Laboratory - The brake-shoe laboratory was transferred to the Department of Theoretical and Applied Mechanics when the Department of Railway Engineering was discontinued in 1940. Because of its long association with the Department of Railway Engineering, however, the description of the equipment is carried under that Department.

Photoelastic Laboratory - In 1922-23, a small collection of apparatus for study of the distribution of stress in irregularly-shaped specimens, such as angles, hooks, gear teeth, turbine blades, I-beams, riveted connections, etc., was brought together in a light-proof basement room of the original Laboratory of Applied Mechanics, where it would be free from disturbances. The specimens used in the experiments were of such transparent materials as glass, celluloid, and bakelite. The equipment consisted of apparatus for producing and analyzing polarized light, and a microscope through which this light could pass and which could be focused upon any part of the specimen.

When the New Materials Testing Laboratory (Arthur Newell Talbot Laboratory) was completed in 1929, the equipment was transferred to one of the rooms on the south side of the top floor of that new building, where the investigations have continued to date.

Plastics Laboratory - In February 1939, experimental work was begun by Mr. W. N. Findley on the mechanical properties of plastics. It was soon found that

because of the effects which small variations in temperature and humidity produce on the mechanical properties of such materials, both of these factors must be controlled during the period of the tests. Accordingly, Room 1-C in the basement of the Arthur Newell Talbot Laboratory was provided with home-made temperature and humidity-control apparatus in order to furnish this constant temperature and humidity condition. This equipment was modified during the next three years, and is now capable of maintaining automatically a constant temperature of 77 degrees F. and a relative humidity of 50 per cent through the year. Various pieces of experimental equipment have been installed in this room over the intervening time. At present, the facilities include a combination tension, compression, and torsion machine for determining the static properties of plastics subjected to those different conditions; five repeated-bending fatigue machines; three rotating-beam fatigue machines; a repeated-impact testing machine; creep-testing apparatus for a total of twenty-four specimens; and such incidental appliances as temperature and humidity-recording instruments, analytical balances, and so on.

Vibrations Laboratory - The study of the characteristics of mechanical vibrations was begun by Professor Thomas J. Dolan about 1939. The apparatus accumulated from time to time since then illustrates the vibrations in machines, mechanical devices, transportation equipment, transmission lines, bridges, and buildings and other structures. Special apparatus available shows the effects of wind in building up vibrations in transmission lines and suspension bridges, and the transfer of vibrations from one mode to another. Special appliances consist of an harmonic analyzer, of frequency meters, and a number of models illustrating the types of motion and relative amplitude developed in free, forced, damped, and self-induced vibrations, and the effects of resonant or critical speeds on machines.

Hydraulics Laboratory - In March 1892, again largely through the interests of Acting Regent Burrill in laboratory work, an appropriation of $525 was given to Professor Talbot as a beginning towards a hydraulic laboratory, which he set up in the first floor of the old Mechanical Building and Drill Hall, or at that time known as Machinery Hall. The equipment purchased included a turbine, a

steam pump for producing high pressures, water motors, water meters, and pressure gages. It included, also, measuring tanks, weir tanks and other apparatus for experimental work with orifices, weirs, etc. In addition, there was a 10-inch standpipe with an elevated supply tank as a source of water supply.

The first regular class instruction in the hydraulics laboratory was given in 1893, apparently the first in this country and probably in the world.

In 1896-97, according to Volume 11 of the Technograph[1] the hydraulic laboratory occupied the north room in the Engineering Laboratory Building[2] and the room on the second floor directly above it. Many improvements had been made during the previous year or two in the facilities for experimenting along various lines of hydraulic investigations. A steel standpipe 4 feet in diameter and 40 feet high, had been erected in the east end of the laboratory. It rested on a concrete foundation seven feet in diameter and five feet in depth. Its largest opening was a short distance above the lower floor, where a quick-opening, 15-inch valve lead to a 15-inch cylinder three feet long. In the end of the cylinder could be fitted plates containing orifices and short tubes of various forms and sizes. At other points in the standpipe, openings were provided for connecting hose in the investigations of friction and discharge from nozzles, for experimenting with jets, and for connecting pipes for the study of flow of water in pipes. The head of water was measured by a mercury column.

In front of the standpipe was a concrete pit 26 feet long, 8 feet wide, and 3½ feet deep. This contained tanks and scales for measuring the quantity of water discharged. The pit itself was also used for measuring larger quantities of water -- the depth being determined by means of a hook gauge.

Water was supplied to the standpipe directly from the city mains through a six-inch pipe running near the north wall and under the floor. Four vertical 4-inch pipes rose from this main supply pipe to furnish water for tests of weirs, meters, motors, etc. The water discharged was weighed in the pit. A 3-inch Venturi meter was connected with one of the risers for purposes of testing.

At the west end of the laboratory was the previously-mentioned 10-inch standpipe 35 feet high connected at the top with a 6-foot wooden tank. At the

1 "The Hydraulic Laboratory," by Paul Chipman '94, pages 125-128.
2 Originally known as Mechanical Building and Drill Hall.

bottom, suitable provision was made for attaching orifice plates, or for making other connections.

A Gordon duplex pump enabled the water to be pumped from the pit to the standpipe or to the wooden tank, and then to be used over again.

Other details of apparatus in the laboratory included a number of plates with round, square, and rectangular orifices of different sizes, short tubes, both straight and converging of various sizes; rectangular, trapezoidal, and triangular weirs of different dimensions; various makes of water meters; a 12-inch Pelton water wheel; two hundred feet of fire hose with a play-pipe; a set of calibrated nozzles for use in measuring quantities of water; and numerous piezometers and other gauges.

Altogether, the equipment was well-designed and well chosen; and in variety, extent, and instructional usefulness, the hydraulic laboratory although very seriously overcrowded for lack of space was not excelled by that of any other engineering school in this country.[1] The work in the laboratory was required of all students in the College of Engineering.

The old building with all of this equipment, and no doubt some added later, was destroyed by the fire of June, 1900, except the 4-foot standpipe, which being full of water remained intact. Without being dismantled in any way, this standpipe was later removed to the new laboratory.[2]

In the new laboratory[3] opened in 1901-02 in the Laboratory of Applied Mechanics Building, the standpipe foundation extended to the level of the main or upper floor. The opening in the upper floor in front of the standpipe was a means of getting light to the lower floor and of communication between the two floors. A number of weir tanks, orifice tanks, measuring tanks, motors, meters, and other similar equipment was placed on the upper floor. A line of pipes, some attached to the north wall and some placed on the balcony directly above, were used for determination of friction in pipes.

---

1 Of thesis work carried on in this laboratory during this early period, two theses may be cited as especially noteworthy --one the flow of water through long pipe siphons by M.S. Ketchum '95, and C.V.Seastone '95; and the other an investigation of water hammer in pipes by E.C.Smith, '99.

2 No laboratory work was given in hydraulics from 1900 to 1901

3 "Laboratory of Applied Mechanics," by A.N.Talbot, The Technograph, 1901-02, pages 83-86.

In the basement of the laboratory were seven measuring pits, two weir chambers, a turbine pit, a sump, and a current-meter rating channel, all made of concrete. All of these pits, sumps and channels were connected with one another and to a waste pipe by a system of piping laid under the floor. One measuring pit was arranged for carrying on work on a large scale with the jet meter. One weir chamber had a three-foot weir with end contractions, and the other a three-foot weir with suppressed-end contractions. The conduit used for rating the current meter was 100 feet in length.

A steam pump and a centrifugal pump and engine pumped water from the sump into the piping system. A line of suction pipe also ran from the sump to the fire pump of the water works located at the east end of the building.

The distribution pipe was suspended from the I-beam of the main floor. A line of 12-inch pipe extended the length of the laboratory to the fore bay of the weir chamber, and was connected with the storage tank of the water works -- those tanks also being available for displacement measurement of water. A line of eight-inch pipe through the laboratory was connected to the pressure tank of the water works. Two lines of 6-inch pipe also ran through the room and also connected with the distribution main of the waterworks. These lines were inter-connected and had connections with the laboratory pumps and standpipe, and had branches running to the main floor. An 8-inch Venturi meter was connected with the system. The water works reservoir could be used as a source of supply and for displacement measurement.

There was added to the equipment of the hydraulic laboratory in 1913-14, a three-stage, direct motor-driven variable speed, centrifugal pump to operate against a head of 400 feet.

When the new Materials Testing Laboratory, now the Arthur Newell Talbot Laboratory, was completed in 1929, the hydraulic equipment was transferred from

the old Laboratory of Applied Mechanics to the first or ground floor and second or main floor of the west wing of that new building.

There are several large concrete channels on the lower floor which may be used both for conducting hydraulic experiments and for receiving water discharged from apparatus on the upper floor. One of these channels is 5 feet by 5 feet in cross-section and 175 feet long. Another is 6 feet wide, and has a depth of 18 feet for a distance of 24 feet, 13 feet 6 inches for a distance of 59 feet, then changes to a weir section 10 feet deep and 37 feet long. In this channel it is possible to make tests involving discharges up to 45 cubic feet per second.

New pumping equipment installed in 1929-30 includes a 500-gallon-per-minute vertical motor-driven sump pump, two 1,000-gallon-per-minute motor-driven centrifugal pumps arranged for parallel or for series operation, and two 2,000 gallons-per-minute pumps similarly connected. All of these pumps operate against a maximum head of 80 feet when used singly or in parallel, and against a head of 160 feet when connected in series. The pumps discharge into a piping system consisting of four lines of 12-inch pipe serving all parts of the laboratory. There was also installed in 1929-30 a pump having a capacity of 30 cubic feet per second (13,500 gallons per minute) against a head of 40 feet, direct-donnected to a 200-horsepower, 2,300-volt, synchronous motor. The pump discharges into a 24-inch spirally-riveted steel pipe line. The water used in the laboratory is re-circulated through pits having a storage capacity of about 90,000 gallons.

A standpipe 6 feet in diameter and 60 feet in height added new in 1929-30, is located in the northeast corner of the west wing of the building. Four over-flow weirs are provided in the standpipe so that a constant head may be held at one of four levels. Since each weir is nearly 16 feet long, the head may be held within a few inches of a constant level under any condition of operation.

The main or upper floor of the laboratory contains weirs, orifice tanks, meter-testing equipment, Venturi meters, a three-stage centrifugal pump capable of delivering 300 gallons per minute against a 460-foot head, impulse water-wheels, motor-driven centrifugal pumps, a 50-horsepower motor-generator set, a hydraulic

ram, a glass-encased turbine, and other apparatus for general student laboratory work.

By means of openings in the floor, covered by removable steel gratings, the water used in experiments may be discharged into steel tanks of various sizes in the lower floor for measurement or direct weighing on platform scales.

Summary - Beginning in 1888 with the first 100,000-pound testing machine, expanding somewhat in 1893, and going on to the 600,000-pound machine in 1905, and the 3,000,000-pound machine in 1929, the materials testing laboratory has kept well in the van among engineering schools. Similarly the hydraulic laboratory from a small beginning in 1892 to a larger installation in 1902 upon completion of the Applied Mechanics Building and the further extension in the new Materials Testing Laboratory in 1929, has had a unique development excelling in quality and variety as an instrument for instructional and investigational purposes. Such laboratory practice as the student gains here coupled with the theory he learns in the classroom assignments, provides him with sufficient training as to form the basis for more advanced work in all engineering fields and to occupy positions in industry where he can be of immediate usefulness to an employer.

In research, the output in reinforced concrete beams, slabs, columns, footings, pipes and frames, in tests of stone, brick and concrete, and in investigations of cast iron and steel columns, in fatigue of metals, and transverse fissures in rails, and in a variety of other experimental and analytical work including investigations in hydraulics, has contained contributions and knowledge that are highly valued by the engineering profession.

E. MISCELLANEOUS

Calibration Room - In the calibration room located in the Arthur Newell Talbot Laboratory are kept the accurate standards of length and weight, with the necessary apparatus for calibrating and standardizing the ordinary equipment of the laboratory. A set of Johannson blocks and auxiliary tools, and special calibrating apparatus may be used in checking and calibrating extensometers and strain gages. A precise Scalers Balance and an analytical balance, together with a set of Class A standard weights certified by the U. S. Bureau of Standards,

permit the standardization of dead weights up to 50 pounds. A Crosby fluid pressure scales is used as a standard of reference for pressure gages of capacities up to 10,000 pounds per square inch. An Amsler standardizing box of 100,000-pound capacity is provided for use in checking the accuracy of testing machines in various laboratories.

Machine Shop Facilities - Two well-equipped machine shops are located in the new Arthur Newell Talbot Laboratory. The shop for the structural research laboratory is conveniently located on the first or lower floor adjacent to the large crane bay. The shop for research and student laboratories in Theoretical and Applied Mechanics is located in the south end of the west wing of the top floor. In 1943, four mechanicians were employed in making specimens for research investigations and for student tests, in constructing apparatus, and in keeping the equipment of the laboratories in the building in repair.

Delivery of heavy materials to the top-floor shop is by a large freight elevator, and by a 10-ton crane. A portable landing platform in one corner of the crane bay allows the crane to deposit its load at any floor level.

F. DEPARTMENTAL MEETINGS

General - Early in its history, the Department began the custom of holding evening dinner meetings once a month for members of the staff and graduate students to discuss matters pertaining to the Department and topics of current interest in the field of mechanics. Most of these meetings are now held in the University Club. Usually some member of the staff presents a paper or talk on some phase of research in progress.

For the last several years, the Department has held meetings of the teaching faculty approximately every week to consider routine matters connected with the administration of the various courses and to discuss topics of interest that should be presented by members of the staff.

G. COLLECTIONS OF PHOTOGRAPHS, DRAWINGS, AND MUSEUM MATERIALS

Photographs - As soon as the new Materials Testing Laboratory was completed in 1929, Professor J. O. Draffin of the Department of Theoretical and Applied Mechanics began to bring together a collection of photographs of men prominent

in the fields of mechanics and hydraulics. These were placed in the corridors of the building where they could be seen by those who have occasion to use or visit the building. In addition, he is attempting, also, to get a collection of photographs of every man that has been connected with the department as teacher or full-time research worker.

H. FACULTY PERSONNEL

General - Brief biographical sketches of the staff members above the grade of assistant that have been connected with the Department of Theoretical and Applied Mechanics, are listed in the following pages in chronological order according to rank.

a. Heads of the Department

General - Arthur Newell Talbot served as Head of the Department of Theoretical and Applied Mechanics from its beginning in 1890 to 1926. Melvin L. Enger was Head from 1926 to 1934, and Fred B. Seely has been Head from 1934 to date (1945). Biographical sketches of these men follow.

Arthur Newell Talbot - The early biographical sketch of Professor Talbot's work was given under Municipal and Sanitary Engineering.

His early activities in practice and in the conduct of these two departments --Municipal and Sanitary Engineering and Theoretical and Applied Mechanics -- produced a background of experience and ripened judgment that prepared Professor Talbot to take full advantage of the increased facilities for work which were provided when the Engineering Experiment Station was organized in 1903. As a matter of fact, he was very influential in the formation of the Station, and he provided the first Station bulletin. His leadership in formulating policies, ideals, and methods made the Engineering Experiment Station an immediate success. A comprehensive and thorough investigation on reinforced concrete, conducted and directed by him, was started in 1903, and was continued for many years on reinforced-concrete beams, slabs, columns, footings, pipes, frames, and buildings. This experimental work became a principal source of the early knowledge on which the properties and requirements for the design of reinforced-concrete structures was based by engineers and engineering organizations and on which the principles and methods of practice were formulated. The conception of relations existing

between the strength of a concrete mixture and items involving the absolute volumes of cement, sand, and coarse aggregate, and the voids in the mixture, as well as the so-called relative water content of the mixture, put forth in a paper in 1921, and in a later bulletin of the Engineering Experiment Station, has proved useful to concrete engineers. Tests of stone, brick, and concrete, the investigation of steel columns and timber stringers, and a variety of other experimental and analytical works have also added to engineering knowledge. There were many contributions, in addition, in the field of hydraulics. Altogether, Professor Talbot was author of thirteen bulletins and was co-author of nine more.

A notable piece of research which Professor Talbot directed from 1914 to 1941 was the investigation of railroad track and described usually as "Stress in Railroad Track". This investigation was conducted with the view of obtaining definite and authoritative information on the properties, mode of action, and resistances developed in the various parts of the track structure (rail, ties, ballast, and roadbed) under the application of locomotives and cars moving at various speeds. At the time the work was begun, comparatively little of a scientific nature was known of the stresses in rail and other parts of the track or the effect on the track of the many variations in action of the rolling stock in its operation. Through the twenty-seven years, with the help of a trained staff, a multitude of tests were made with a number of different types of locomotives and cars on track of more than twenty railroads in different parts of the country. Besides, much experimental work supplementing the field tests was carried on in the laboratory. Data from all these tests were interpreted and coordinated with analytical treatment to establish principles and findings. In addition to many minor reports of this engineering research, Doctor Talbot prepared seven formal reports, all of which were printed in the Proceedings of the American Railway Engineering Association and part of which were published in the Transactions of the American Society of Civil Engineers. This research project produced reliable knowledge on the interrelation between track and rolling equipment, and thus aided in putting on a more nearly rational basis the design and construction of the track structure to carry locomotives and cars

under modern traffic conditions, as well as giving valuable information applicable to the design of rolling stock. Commendation by railroad engineers in important executive and supervisory positions is indicative of the value placed on the investigation by men fitted to pass judgment. It has been characterized as one of the most significant contributions to the scientific knowledge of railroads ever made. On March 11, 1925, the American Railway Engineering Association at its annual convention held in Chicago, passed a resolution of appreciation and commendation of this work done by Professor Talbot and his assistants.

Having attained a high rank among engineering teachers, Professor Talbot was an influential member of the Society for the Promotion of Engineering Education after its formation in 1893, holding various offices including that of President. He was President of the American Society for Testing Materials in 1913-1914, and was prominent in the work of the American Society of Civil Engineers, serving on its research and other committees and on its Board of Direction. He was President of the Society in 1918. He was a member of a number of other engineering societies in this country and abroad, in all of which he gave service in one way or another by written contributions or by direction.

For forty-five years, Professor Talbot moulded and inspired generations of young men. During that time he selected and trained many men for teaching and research positions. He always took a keen interest in the men on his staff and used every means to promote their progress and development. Those associated with him could not be unaffected by the force of his example, by his high ideals, and by his strong personality. Among those who worked with Professor Talbot, are many men in all parts of the world who were so inspired by his personality, depth of knowledge, and enthusiasm, that it gave them such an understanding and vision of their work as to make them more than mere technical experts in their chosen professions. It made them leaders in various fields in th science of engineering.

In addition to his teaching work, Professor Talbot spent such time as his

educational and research schedule permitted in engineering practice on railroad construction, on pavements, sewerage and water works, and on reinforced-concrete design and construction. He acted as consultant to cities and business organizations on numerous occasions. To cite only two of his commissions, he served on one board to determine the type of structure for the Galveston causeway and on another to make a preliminary report on the location of a bridge over San Francisco Bay between San Francisco and Oakland. However, his research and administrative work, and his connections with technical committees always had such claim on his time, energy, and affection that he never faltered throughout the years in his purpose to limit the principal contributions of his life to engineering education, engineering research, and the utilization of the fruits of research through engineering society channels.

A portrait of Professor Talbot, painted by Ralph Clarkson of Chicago, was presented to the University by former students, colleagues, and other friends. The portrait hangs in the Engineering Library. The formal presentation was made by Doctor W. L. Abbott, '84, at a convocation of the College of Engineering on March 27, 1925, and the acceptance was by President Kinley. The principal speaker at the convocation, Edward J. Mehren '06, Vice-President of the McGraw-Hill Company, after a brief biographical sketch of Professor Talbot's life and activities and a critical estimate of the value of his work to society, concluded as follows:

"This is his great achievement. This is the work that makes him brother of those giants who since the days of Watt have been bearers of gifts to humanity. Into that grand galaxy of engineers' names fits worthily his name, the name of our teacher, our inspiring leader in science and in engineering, our lovable friend, Professor Arthur Newell Talbot."[1]

On September 1, 1926, Professor Talbot reached the University age limit and was retired with the title of Professor of Municipal and Sanitary Engineering, <u>Emeritus</u>. After his retirement, though, he continued to be actively engaged in directing his extensive research programs and in participating in the affairs of engineering societies.

---

1 The subject of Mr. Mehren's address was "The True Measure of Engineering Achievement".

Professor Talbot received so many honors and awards during his lifetime that his biographical sketch would be woefully incomplete without some brief record of these testimonials commemorating his achievements.

At a special convocation held at the University on April 21, 1938, which was attended by students, faculty, and many prominent visitors representing the engineering profession, the Materials Testing Laboratory was renamed the Arthur Newell Talbot Laboratory. This was an unusual procedure, for only in one other instance had a University building been named after a living person. In connection with this event, President Willard wrote the following tribute:

"The University of Illinois takes this occasion to recognize and acclaim a distinguished son, Arthur Newell Talbot of the Class of 1881. Honors and awards, degrees and memberships, medals and tablets attest to the lifetime achievements in many scientific fields of Doctor Talbot, Professor of Municipal and Sanitary Engineering, Emeritus. Over a period of nearly sixty years his contributions to engineering education, research, and practice have grown more and more notable until today he is an acknowledged leader among engineering teachers, research organizers, scientific investigators and writers, and, above all, among men. Many generations of college students have gone forth from this institution inspired by his high standards, and impressed by his sterling character and unwavering devotion to his ideals. It now remains for his Alma Mater to signalize for future generations of students the enduring contributions of this man to the engineering profession by placing his name on a great materials testing laboratory at the University of Illinois".

Dean M. L. Enger presided at the Convocation,-short talks being given by Mr. Orville M. Karraker of the Board of Trustees, President Willard, and Professor Talbot. The main address of the occasion was by Dr. Robert Ernest Doherty, '09, President of Carnegie Institute of Technology on the subject "Technology, Education, and Social Welfare".

On October 21, 1941, the American Railway Engineering Association held a special convocation at the University, which was attended by a large representation of its own membership as well as by students and faculty of the University, in order to present to the University a bronze plaque honoring Professor Talbot on the occasion of his eighty-fourth birthday for his outstanding services to that Association. The plaque placed in the Arthur Newell Talbot Laboratory bears the following inscription: .

"A.D. 1941

to
Arthur Newell Talbot

With affectionate admiration of his fine personality, the American Railway Engineering Association inscribes this tablet in recognition of his pre-eminence in engineering education and research where he has made notable contributions to the science of engineering and in acknowledgment of his brilliant research as Chairman of the Association's Committee on Stresses in Railroad Track from 1914 to 1941 whereby were brought to light facts and principles on which to found a rational basis for the design of track of great value to railroad transportation."

Professor Talbot was honored also by a number of other plaques or tablets.

They include the following:

1. A tablet placed in 1924 at the Urbana and Champaign Sanitary District Building, which states among other things "On this site, 1897, The Champaign Septic Tank was built. Designed by Prof. A. N. Talbot. It was among the first of its kind in this country".
2. A bronze plaque presented in 1925 by the American Railway Engineering Association which reads: "An appreciation to Arthur Newell Talbot, worker in research and scientific advancement". This was accompanied by resolutions reciting "....its high appreciation of you as a scientist, and teacher, and investigator and organizer, and, last but not least, as a man".
3. A bronze tablet by students on the occasion of the second biennial Illinois Student Engineering Exhibit, on April 17, 1937, which "Honors the Achievements of Arthur Newell Talbot and His Contributions to Engineering and the Prestige of the College of Engineering, University of Illinois".

The medals and awards presented to Professor Talbot include the following:

1. The Washington Award of the Western Society of Engineers in 1924 "For pre-eminent services in promoting the public welfare, for his life work as student and teacher, investigator and writer, and for his enduring contribution to the science of engineering".
2. The George Henderson Medal by the Franklin Institute in 1924 as "No. 5 for Invention in Railway Engineering".
3. The Henry C. Turner Medal by the American Concrete Institute in 1928 "For outstanding contributions to the knowledge of reinforced concrete design and construction".
4. The Benjamin Garver Lamme Medal by the Society for the Promotion of Engineering Education in 1932 for "Achievement in Engineering Education".
5. The John Fritz Medal by the United Engineering Societies in 1937 which states "Moulder of men, eminent consultant on engineering projects, leader of research and outstanding educator in civil engineering".

The following honorary degrees were conferred upon Professor Talbot:

Doctor of Science, by the University of Pennsylvania in 1915; Doctor of Engineering, by the University of Michigan in 1916; and Doctor of Laws by the University of Illinois in 1931.

Professor Talbot was recipient of the following honorary memberships:

Institution of Structural Engineers, London, 1913; American Society for Testing Materials, 1923; Illinois Society of Engineers, 1924; American Society of Civil Engineers, 1925; Western Society of Engineers, 1927; American Water Works Association, 1930; American Concrete Institute, 1932; and American Railway

Engineering Association, 1933.[1]

Even after he had passed the four-score milestone in years, Professor Talbot continued to be persistently active in matters pertaining to engineering. In fact, it was while attending and actively participating in the affairs of the annual meeting of the American Railway Engineering Association in Chicago, that he was suddenly taken with serious illness, which resulted in his death there only a few days later,-on April 3, 1942.

Melvin Lorenius Enger See Deans, Chapter V

Fred B. Seely was born at Chester, New York, on April 29, 1884. He received the B. S. degree from the University of Illinois in 1915. He was engaged in engineering practice during 1907-08, and served as Instructor in Mechanical Engineering at Villa Nova College in 1908-09. He came to the University of Illinois in 1909 and became successively Instructor, Associate, Assistant Professor, and Associate Professor of Theoretical and Applied Mechanics until 1921, when he was appointed Professor of Theoretical and Applied Mechanics. He has served as Head of the Department since 1934.

Professor Seely is co-author with Professor N. E. Ensign of a textbook entitled "Analytical Mechanics for Engineers". He is author of two other texts in mechanics: viz, "Resistance of Materials", and "Advanced Mechanics of Materials". He is the co-author of one bulletin and is joint author of five more, of the Engineering Experiment Station. For a number of years, Professor Seely has been Chairman of the College of Engineering Committee on College Policy and Development.

b. Other Professors

Herbert Fisher Moore, (B. S., 1898, New Hampshire State College; M. E., 1899, and M. M. E., 1903, Cornell University), was Instructor in Machine Design at Cornell University during 1900-03. He then served as Instructor in Machine Design in Drexel Institute, and Mechanical Engineer for Riehle Bros. Testing Machine

1 Much of the material in this biography was taken from a University of Illinois publication Vol. XXXV, No. 62, issued on April 1, 1938, entitled "Arthur Newell Talbot Laboratory, a Tribute to Arthur Newell Talbot".

Company, Philadelphia, 1903-04; Instructor and Assistant Professor of Mechanics, University of Wisconsin, 1904-07; Assistant Professor of Theoretical and Applied Mechanics, University of Illinois, 1907-14; and Research Professor of Engineering Materials from 1914-44. He is the designer of the 600,000-pound testing machine in the materials testing laboratory of the University of Illinois, and also of a similar one belonging to the University of Wisconsin. He is the author of an excellent textbook of "Engineering Materials"; and is the author of six bulletins and eleven reprints, and is co-author of twenty bulletins, one circular, and one reprint of the Engineering Experiment Station. He is noted as an expert machine designer, a skillful manipulator, and a resourceful and versatile investigator.

At the Commencement exercises in June, 1923, Professor Moore was granted the honorary degree of D. Sc. by his alma mater, New Hampshire State College, in recognition of his achievements in the field of mechanics.

On the evening of November 3, 1930, a dinner was tendered Professor Moore by 86 members of the faculty of the University and other friends here, in Bradley Hall, in recognition of his researches in fatigue of metals and in celebration of the awarding to him of the 1930 American Iron and Steel Institute Medal.

Professor Moore was invited to give the annual Howe Memorial Lecture before the meeting of the American Institute of Mining and Metallurgical Engineers at New York City in 1936. This was a signal honor, for such an invitation is extended only to individuals of recognized and outstanding attainment in the science and practice of iron and steel metallurgy or metallography.

Professor Moore reached the University age limit in September, 1943, but at the request of the administration, continued in active work for another year, retiring in September, 1944, as Research Professor of Engineering Materials, Emeritus, leaving with the University the rich heritage that accrues from outstanding achievements in his chosen profession.

Harald Malcolm Westergaard, (B. S., 1911, Royal Technical College, Copenhagen; Ph. D., 1916, University of Illinois; and Dr. Eng., 1925, Technische Hochschule, Munich, Germany), was engaged in practical industry from 1911 to 1914, then served

as Instructor in Theoretical and Applied Mechanics at the University of Illinois during 1916-19, Associate 1919-21, Assistant Professor 1921-24, Associate Professor 1924-27, and Professor 1927-36. He resigned in September, 1936, to become Gordon McKay Professor of Civil Engineering at Harvard University, and was made Dean of the Graduate School of Engineering at Harvard University then in 1937. Doctor Westergaard earned an international reputation for the brilliant application of the theory of elasticity to engineering structures,-many of his mathematical solutions have settled problems that had baffled engineers for years. He was awarded the Leonard C. Wason Medal by the American Concrete Institute in 1922, and the J. James R. Croes Medal of the American Society of Civil Engineers in 1935 for his paper entitled "Water Pressure on Dams during Earthquakes".

Professor Westergaard was granted the honorary degree of Dr. Tech. by the Royal Technical College, Copenhagen, in 1929, and the D. Sc. degree by Lehigh University in 1930.

Frank Erwin Richart, (B. S., 1914, M. S., 1915, and C. E., 1922, University of Illinois), was engaged in engineering practice during 1915-16, after which he became Instructor in Theoretical and Applied Mechanics at the University. He served as Research Associate during 1919-21, Research Assistant Professor during 1921-28, Research Associate Professor during 1928-31, and Research Professor of Engineering Materials from 1931 to date. Professor Richart is author of one bulletin and co-author of thirteen more issued by the Engineering Experiment Station. He served as Vice-president of the American Concrete Institute in 1937 and as President in 1938. He was awarded the Leonard C. Wason medal by the American Concrete Institute in 1938 for a paper entitled "Rigid and Long-Time Tests of Reinforced Knee Frames".[1]

Professor Richart's experimental work has done much to extend the range of knowledge of concrete construction, and has added immensely to the place the University holds in the scientific world.

Howard Rice Thomas, (C. E., 1912, University of Texas; M. S., 1914, University

1 Mr. T. A. Olsen was joint author of the paper.

of Illinois), was employed as testing and research engineer for the American Society of Civil Engineers, the American Railway Engineering Association, U. S. Government, and the University of Texas Bureau of Engineering Research, between 1914 and 1928. In 1928, he became Special Research Associate Professor of Engineering Materials at the University of Illinois, and in 1931, Special research Professor. He left the University in October, 1941. Professor Thomas is joint author of one bulletin and one reprint of the Engineering Experiment Station.

William James Putnam, (B.S. in E.E., 1910, M.S. in T.A.M., 1919, and M.E., 1930, University of Illinois), was engaged in engineering practice from 1910 to 1914, and came to the University as Instructor in Theoretical and Applied Mechanics in September, 1914. He became Associate in 1919, Assistant Professor in 1921, Associate Professor in 1930, and Professor in 1934, and has remained with the University to date (1945). Professor Putnam is joint author of two bulletins of the Engineering Experiment Station.

Jasper Owen Draffin, (B.S. 1913, University of Vermont; M.S., 1916, University of Illinois), was employed in engineering practice during 1913-14. He became Instructor in Mechanics at the Ohio State University in 1916 and continued there until 1919. He was successively Instructor, Associate, Assistant Professor, and Associate Professor in the Department of Theoretical and Applied Mechanics at the University of Illinois during 1919-1935, and since 1935 has been professor of Theoretical and Applied Mechanics here.

He is joint author of one bulletin and one reprint of the Engineering Experiment Station, and author of two ~~two~~ text books entitled "The Story of Man's Quest for Water" and "Strength of Materials".

Herman John Schrader, (B.S., 1923, Purdue University; M.S., 1937, University of Illinois), spent two years in railway engineering practice after graduation, then came to the University in September, 1925, as Instructor in Railway Mechanical Engineering in the Department of Railway Engineering. He became Associate in 1930, Assistant Professor in 1934, and Associate Professor in 1939. When the Department of Railway Engineering was discontinued in 1940, Professor Schrader was transfered to the Department of Theoretical and Applied Mechanics with the title of Research Associate Professor of Theoretical and Applied Mechanics. In 1943, he was made Research Professor in the same department. Professor Schrader is author of one bulletin and co-author of three more published by the Engineering Experiment Station, his principal experiments having

been in connection with studies relating to railway car and brake-shoe performance.

Newton Edward Ensign, (A.B., 1905, McKendree College; B.A., 1908, and M.A., 1932, Oxford), was Rhodes Scholar at Oxford, England, during 1905-08. He served as Instructor in the University of Illinois Academy during 1909-10, as Instructor in Theoretical and Applied Mechanics here during 1910-15, as Associate during 1915-21, as Assistant Professor during 1921-30, and as Associate Professor during 1930-45. Since 1945, he has had the title of Professor of Theoretical and Applied Mechanics. Professor Ensign is co-author of a textbook entitled "Analytical Mechanics for Engineers".

William Louis Schwalbe, (B.S. in C.E., 1911, University of Wisconsin; M.S., 1920, University of Illinois), was engaged in engineering work after graduation until 1920, when he joined the staff at the University of Illinois as Instructor in Theoretical and Applied Mechanics. He was made Associate in 1924, Assistant Professor in 1932, Associate Professor in 1941, and Professor in 1945. Professor Schwalbe is co-author of one bulletin of the Engineering Experiment Station.

Thomas James Dolan, (B.S. in C.E., 1929, and M.S., 1932, University of Illinois), became Instructor in Theoretical and Applied Mechanics in September, 1929, Assistant Professor in 1937, Associate Professor in 1941, and Professor in 1945. He is author of one bulletin and joint author of four more published by the Engineering Experiment Station. He was on leave of absence for war work from September 1, 1942, until November 16, 1945.

c. Associate Professors

Jesse Benjamin Kommers, (B.S. in E.E., 1906, and M E., 1922, University of Wisconsin), served as Instructor in Applied Mechanics at his alma mater during 1907-13 and as Assistant Professor during 1913-20. He became Special Research Associate Professor of Engineering Materials at the University of Illinois in 1919 on a special appointment for two years to engage in research on fatigue of metals in cooperation with Professor H.F. Moore. In September, 1921, Professor

Kommers returned to the University of Wisconsin, where he became Professor of Mechanics in 1927 and has retained that position to date. Professor Kommers is co-author with Professor Moore of one bulletin in the Engineering Experiment Station.

Thomas McLean Jasper,(B.S., 1911, M.S., 1911, and C.E., 1921, University of Illinois), was employed in practical engineering work until he joined the college staff in September, 1921, as Special Research Assistant Professor of Engineering Materials. He was made Special Research Associate Professor in 1925, but resigned in March, 1926, to accept a position in the research department of the A.O. Smith Corporation at Milwaukee, Wisconsin. Later, he became Director of that department. Professor Jasper is joint author of three bulletins of the Engineering Experiment Station.

Vernon Peter Jensen, (B.S., 1929, and M.S., 1931, University of Illinois; Ph.D. 1936, Iowa State College), became Special Research Assistant in Theoretical and Applied Mechanics in 1929, but withdrew in February, 1930, for further study. He returned in 1936 as Special Research Assistant Professor, and was made Special Research Associate Professor of Engineering Materials in 1941. He was given a leave of absence on July 15, 1943, for war service, but resigned on October 1, 1945. Doctor Jensen is author of three bulletins and co-author of two others issued by the Engineering Experiment Station.

Wallace Monroe Lansford, (B.S. in C.E., 1924, M.S., 1929, and C.E., 1931, University of Illinois), became Instructor in Theoretical and Applied Mechanics in September, 1929, Associate in 1933, Assistant Professor in 1937, and Associate Professor in 1943. Professor Lansford is author of two bulletinge and co-author of one more published by the Engineering Experiment Station.

Ralph Ellsworth Cramer, (A.B., 1920, Simpson College; M.S., 1935, University of Illinois), was Instructor in Chemistry at Iowa State College from 1920 to 1923. From 1923 to 1931, he was engaged in commercial work in chemistry and metallurgical engineering. He was made Special Research Assistant in Engineering materials in July, 1931, to carry on the metallographic work in connection with the Rails

Investigation at the University of Illinois. He became Special Research Assistant Professor in 1943. Professor Cramer is author of two and co-author of one reprint of the Engineering Experiment Station.

Norville James Alleman, (B.S. in M.E., 1926, M.S., 1929, and M.E., 1937, University of Illinois), was made Special Research Assistant in Engineering Materials in 1926, Special Research Associate in 1938, Special Research Assistant Professor in 1941, and Special Research Associate Professor in 1943. Professor Alleman's special interest is in the creep of lead and lead alloys, and he is co-author of three bulletins and two reprints issued by the Engineering Experiment Station.

William Leighton Collins, (B.S. in C.E., 1928, and M.S., 1932, University of Illinois), became Instructor in Theoretical and Applied Mechanics in September, 1929, Associate in 1937, Assistant Professor in 1939, and Associate Professor in 1945. He was on leave of absence for war work from September 1, 1942, until October 1, 1945.

Clifford Proctor Kittredge, (B.S., 1929, Massachusetts Institute of Technology; Doctor der Technischen Wissenschaften, 1933, Technische Hochschule, Munchen, Germany), received the Freeman Travelling Fellowship for graduate study abroad in hydraulics, and came to the University in September, 1936, as Assistant Professor of Theoretical and Applied Mechanics. On November 1, 1941, he was given a leave of absence for war service. In October, 1945, he was given the rank of Associate Professor, but did not return to assume the position.

D. ASSISTANT PROFESSORS

Charles Henry Hurd, (B. S., 1900, University of Chicago), served in practicing and teaching positions until 1905, when he came to the University as Assistant Professor of Theoretical and Applied Mechanics in charge of testing and hydraulic laboratories. He withdrew at the end of that school year, however, to re-enter engineering practice.

Roy Victor Engstrom, (B. S. in M. & S. E., 1904, University of Illinois), served as Instructor in Theoretical and Applied Mechanics and Municipal and Sanitary Engineering in 1905, but withdrew in 1906 to engage in practical work. He returned to the Department in 1907 as Associate. He was made Assistant Professor in 1909, but resigned in 1910 to take up engineering practice again.

William Appleford Slater, (B. S. in M. & S. E., 1906, M. S., 1910, and C. E., 1912, University of Illinois), served as First Assistant, Engineering Experiment Station, Theoretical and Applied Mechanics, during 1910-15 and Research Assistant Professor of Applied Mechanics during 1915-17. He resigned on May 20, 1917, to take charge of research work for the Emergency Fleet Corporation, but in 1919 became Engineer-Physicist of the U. S. Bureau of Standards in charge of reinforced-concrete research. In 1928, he became Research Professor of Engineering Materials and Director of the Fritz Engineering Laboratory at Lehigh University, and remained there until his death on October 5, 1931. His studies and contributions to the technical press made a marked impression on the standards and practice of reinforced-concrete construction. He was co-author of one bulletin of the Engineering Experiment Station.

Virgil Ramsay Fleming, (B. S. in C. E., 1905, University of Illinois), spent the first two years in practice after graduation, and became Instructor in Theoretical and Applied Mechanics at the University here in 1907. He was made Associate in 1911, and Assistant Professor in 1917, and remained with the University until his death on March 20, 1944. Professor Fleming was joint author of one bulletin of the Engineering Experiment Station.

Harrison Frederick Gonnerman, (B. S. in C. E., 1908, and M. S., 1913, University

of Illinois), served as Assistant in the Engineering Experiment Station here during 1908-10, Instructor in Theoretical and Applied Mechanics during 1910-14, Research Associate during 1917-18, and Research Assistant Professor during 1919-1920. He resigned in 1920, to engage in engineering practice. In 1922, he was made Associate Engineer in the Structural Materials Research Laboratory of Lewis Institute. He remained in this position until 1927, when he became Manager of the Research Laboratory of the Portland Cement Association, which position he has retained to date. Mr. Gonnerman is co-author of one bulletin issued by the Engineering Experiment Station at the University of Illinois and of many articles in the technical press.

Nereus Hubert Roy, (B.S., 1920, University of Texas; Honorary B.S.C.E., 1923, University of Mexico, Mexico City; M.S., 1929, and C.E., 1930, University of Illinois), was engaged in practical engineering work until he joined the College staff as Special Research Assistant in Theoretical and Applied Mechanics in 1930 on the Rails Investigation project. In April, 1931, he was made Special Research Assistant Professor of Engineering Materials, and retained that position until his resignation in 1937. Professor Roy is joint author of one bulletin of the Engineering Experiment Station.

Ralph Wendell Kluge, See Civil Engineering, Chapter VIII

Curtis Walter Dollins, (B.S., 1930, and M.S., 1933, University of Illinois), became Special Research Associate in Engineering Materials at the University here in June, 1937, and Special Research Assistant Professor in 1943.

William Nichols Findley, (A.B., 1936, Illinois College; B.S.E., 1937, University of Michigan; M.S., Cornell University), became Instructor in Theoretical and Applied Mechanics in 1939, Associate in 1942, and Assistant Professor in 1943. Professor Findley was awarded the Charles B. Dudley medal of the American Society for Testing Materials in 1945 for his paper intitled "Creep Characteristics of Plastics".

Edward Washington Suppiger, (B.S. in C.E., 1928, M.S., 1932, and Ph.D., 1942 in T. & A. M., University of Illinois), became Instructor in Theoretical

and Applied Mechanics here in September, 1929, and Associate in 1937. In July, 1942 he was given a leave of absence for war service. In October, 1945, he was promoted to Assistant Professor, but accepted a position at Princeton University. He is author of one bulletin published by the Engineering Experiment Station.

Paul Guy Jones, (B.S. in E.E., 1933, and M.S., 1940, University of Illinois), became Instructor in Theoretical and Applied Mechanics in 1937, Associate in 1941, and Assistant Professor in 1945.

James Ohrea Smith, (A.B., 1930, B.S., 1933, and A.M., 1935, University of Alabama), became Instructor in Theoretical and Applied Mechanics at the University of Illinois in 1937, but resigned in 1938. He returned to the Department in September, 1941, as Associate in Theoretical and Applied Mechanics and was given a leave of absence on September 1, 1942, for war service. He returned to the University in October, 1945, with the title of Assistant Professor. He is author of two bulletins issued by the Engineering Experiment Station.

Winston Edward Black (B.S., 1936, and C.E., 1942, University of Illinois; M.S., 1938, Lehigh University), became Instructor in Theoretical and Applied Mechanics in September, 1938, and was made Assistant Professor in 1945. He is author of one bulletin published by the Engineering Experiment Station. He was on leave of absence for war work from September 1, 1942, until October 1, 1945.

Chester Paul Siess, (B.S., 1936, Louisiana State University; M.S., 1939, University of Illinois), became Special Research Associate in Theoretical and Applied Mechanics in September, 1941, and Special Research Assistant Professor in 1945. He is co-author of one bulletin of the Engineering Experiment Station.

e. Associates

Lewis Eugene Moore, (B.S. in M.E., 1900, and C.E.,1906, University of Wisconsin), was engaged in engineering practice until he joined the College faculty in 1904 as Instructor in Theoretical and Applied Mechanics. He was made Associate in 1906, but withdrew in 1907 to re-enter engineering practice.

Herbert Lucius Whittemore, (B.S., 1903, and M.E., 1910, University of Wisconsin), spent three years in practice abroad, then joined the faculty at the University of Illinois as Instructor in Theoretical and Applied Mechanics. He became Associate in 1907, and remained here until 1910, when he resigned to accept an appointment with the Watertown Arsenal.

Duff Andrew Abrams, (B.S., 1905, and C.E., 1909, University of Illinois), was Assistant in the Engineering Experiment Station here during 1905-07 and Associate during 1907-14. He resigned to accept a position as Professor in charge of the Structural Materials Research Laboratory at Lewis Institute. He remained at Lewis until 1927, when he withdrew to become Director of the International Cement Corporation, in New York. He served this position until 1931, then became consulting engineer on concrete and concrete products, which position he has held to date. Professor Abrams discovered and developed many new principles in concrete construction, one of which was the water-cement ratio in concrete construction. He is author of one bulletin and co-author of another, issued by the Engineering Experiment Station.

George Paul Boomsliter, (B.S. in C.E., 1906, Michigan State College; M.S., in T.A.M., 1941, University of Illinois), was engaged in engineering practice before joining the faculty of the University of Illinois in September, 1910, where he served in turn as Instructor and Associate in Theoretical and Applied Mechanics until February, 1920. He withdrew from the Department to become Professor of Mechanics at the University of West Virginia, where he has continued to the present time.

Louis John Larson, (B.S., 1914, and C.E., 1915, University of Minnesota; M.S. 1917, University of Illinois), served for two years as Assistant and Associate Engineer-Physicist at the U.S. Bureau of Standards, and was later Chief Engineer of the Lumber, Tie, and Timber Vulcanizing Company. He came to the University of Illinois in February, 1920, as Instructor in Theoretical and Applied Mechanics and became Associate in 1922. He resigned in January, 1927, to re-enter engineering practice. Mr. Larson is co-author of one bulletin of the Engineering Experiment Station.

Rex Lenoi Brown, (B.S., 1919, University of Kansas; M.S., 1921, University of Illinois), was appointed Research Assistant in Theoretical and Applied Mechanics here in 1921 and Research Associate in 1925. In 1937-38, Mr. Brown was transferred to full-time teaching work with the title of Associate in Theoretical and Applied Mechanics. He is joint author of six bulletins of the Engineering Experiment Station.

LeRoy Tucker, (A.B., 1912, Washburn College; B.S. in Ry. Civ. Eng., 1923, C.E., 1928, and M.S., 1931, University of Illinois), was engaged in engineering practice for a time, then served as Professor of Mechanics at Clemson College from 1926 to 1929. He was appointed for one year as Associate in Theoretical and Applied Mechanics here to take over the teaching work of Professor H.M. Westergaard while he was on leave of absence during 1929-30. He later joined the staff at Ohio State University, and in 1943 was Assistant Professor of Mechanics there.

Joseph Louis Besesi, (B.S. in Ry. E.E., 1923, E.E., 1934, and M S. 1938, University of Illinois), was employed in practical engineering work after graduation until he came to the University in June, 1931, as Special Research Assistant in Engineering Materials, to work on the Rails Investigation. He was made Special Research Associate in 1938, and remained with the Department until July, 1941.

Howard Creighton Roberts, (A.B. 1933, University of Illinois), began as Special Research Associate in Theoretical and Applied Mechanics in March, 1942. He remained on the Staff until September, 1944.

Roy Kenneth Jacobs, (B.S. in C.E., 1931, and B.S. in Ed., 1933, Ohio Northern University; M.S. in C.E., 1938, University of Michigan), served as Associate in Theoretical and Applied Mechanics from September, 1942, to August, 1943.

Jorj Oscar Osterberg, (Ph.D., 1940, Cornell University), became Associate in Theoretical and Applied Mechanics in September, 1942, but resigned in August, 1943.

Russell S. Jensen, (B.S., 1936, University of Illinois), became Special Research Assistant in January, 1942, and Special Research Associate in September, 1943.

He is co-author of one bulletin and one reprint of the Engineering Experiment Station.

Dimitry Morkovin, (B.S. (B.A.), 1934, M.B.A., 1935, and B.S. in M.E., 1937, University of Southern California; Ph.D., 1944, University of Illinois), became Instructor in Theoretical and Applied Mechanics in February, 1942, and Associate in September, 1943. He withdrew from the staff, however, in September, 1944.

Arthur Ulrich Theuer, (B.S., 1928, Leland Stanford, Jr., University), became Special Research Associate on the cooperative investigation of Reinforced Concrete Footings in September, 1944, after spending several years in engineering practice in state and federal service.

Omar Marion Sidebottom (B.S., 1942, and M.S., 1943, University of Illinois) became Special Research Assistant in September, 1943, in connection with the car-wheel and brake-shoe investigations, and Special Research Associate in 1945.

Myron Lee Gossard (B.S., 1937, and M.S., 1939, University of Illinois), after teaching experience at Iowa State College and the University of Louisville, and industrial practice with a number of firms, became Special Research Associate in October, 1945.

f. Instructors and Research Assistants

Lorin William Peabody, (B.S. in M.E., 1891, University of Illinois), served as Instructor in Theoretical and Applied Mechanics during 1893-95.

Frederick Alexander Mitchell, (B.S. in M.E., 1898, University of Illinois), was employed in engineering practice until 1901, when he became Instructor in Theoretical and Applied Mechanics at the University. He withdrew in 1903 to take up practical work again.

Frank A. La Motte, (M.S., 1900, University of Chicago), was Instructor in Theoretical and Applied Mechanics here during 1905-06.

Roy Harley Slocum. See Municipal and Sanitary Engineering, Chapter XII

John Jefferson Richey. See Civil Engineering, Chapter VII

Charles Henry Pierce, (B.S., 1904, University of Vermont), was employed in engineering practice until he joined the staff at the University of Illinois in

1905 as Instructor in Theoretical and Applied Mechanics. He resigned at the end of the academic year to accept an appointment at the University of Vermont.

Walter Louis Cronin, (B. S. in M. E., 1904, Massachusetts Institute of Technology), was Instructor in Theoretical and Applied Mechanics at the University here during 1905-06.

Harry Woy Gray, (B. C. E., 1906, Iowa State College), served as Instructor in Theoretical and Applied Mechanics at the University of Illinois during 1906-07. He withdrew to engage in engineering practice, and died in 1913.

Ward Reid Robinson, B. S., 1906, and C. E., 1909, University of Illinois), was Research Assistant in Theoretical and Applied Mechanics here during 1906-09.

Tansey (Thomas) Radford Agg, See General Engineering Drawing, Chapter XVII

Carl Wagner, (B. S. in M. E., 1906, Purdue University), spent two years in engineering practice and then came to the University of Illinois as Instructor in Theoretical and Applied Mechanics. He resigned in 1909 to engage in commercial work.

Frederick William Doolittle, (A. B., 1905, Princeton University; B. S., 1907, and M. S., and C. E., 1911, University of Colorado), was Instructor in Theoretical and Applied Mechanics at the University here during 1908-09, after which he went to the University of Colorado as Instructor in Structural Engineering.

Harvey Ellison Murdock. See Municipal and Sanitary Engineering, Chapter XII

Clarence Eugene Noerenberg, (B. S. in A. E., 1907, A. E., 1909, and A. B., 1910, University of Illinois), joined the College staff here in September, 1909, as Instructor in Theoretical and Applied Mechanics, and remained with the University until 1916, when he withdrew to accept an appointment in engineering practice.

Stanley Prince Farwell, (B. S. in E. E., 1907, M. S., 1910, and Ph. D., 1914, University of Illinois), was with the Western Electric Company from 1900 to 1904, and with the Oklahoma Gas and Electric Company from 1904 to 1908. He served as Assistant Professor of Electrical Engineering at Central University of Kentucky from 1908 to 1910 and as Instructor in Theoretical and Applied Mechanics at the University of Illinois from 1910 to 1913. He was Service Engineer for the Illi-

nois Public Utilities Company from 1914 to 1917, and Industrial Engineer with Arthur Young & Company from 1917 to 1920. Since 1920, Mr. Farwell has been connected with the Bureau of Commercial Economics, Inc., Chicago, and its successor, The Business Research Corporation. He was Vice-president and Director of the organization from 1920 to 1934, and since 1934, has served as President and Director.

Floyd Hays Millard, (B. S. in C. E., 1910, University of Colorado; M. S., 1912, University of Illinois), was Instructor in Theoretical and Applied Mechanics here during 1912-13.

Alexander Vallance, (M. E., 1909, Ohio State University), served as Assistant Professor of Experimental Engineering at Ohio State University during 1910-13, and became Instructor in Theoretical and Applied Mechanics at Illinois in September, 1913. He remained in this position until 1916, when he resigned to accept a position as Assistant Professor of Experimental Engineering at Georgia Institute of Technology.

Harry Gardner, (B. S. in C. E., 1905, University of Wisconsin; M. S., 1911, University of Kansas), served as Assistant City Engineer of Madison, Wisconsin, during 1902-05, and was Instructor in Civil Engineering at Illinois during 1905 1907. He then served as Professor of Mathematics at Iowa Wesleyan University during 1907-09 and as Assistant Professor of Civil Engineering at the University of Kansas during 1909-13. He was Instructor in Theoretical and Applied Mechanics here during 1913-16, resigning in 1916 to accept a position in Cooper Union.

Solomon Cady Hollister, (B. S. in C. E., 1916, University of Wisconsin), became Instructor in Theoretical and Applied Mechanics at the University of Illinois in September, 1916, but resigned in September, 1917, to accept an appointment with the Concrete Ship Division of the Emergency Fleet Corporation of the U. S. Government. He later joined the faculty of Purdue University and still later, of Cornell University, becoming Director of the School of Civil Engineering and afterwards Dean of the College of Engineering.

Josiah Frank Ward, (B. S., 1914, and C. E., 1915, Northwestern University), was employed in engineering practice until October, 1917, when he joined the staff

at the University of Illinois as Research Assistant in Theoretical and Applied Mechanics. He resigned in March, 1918.

Floyd Hamilton Fish, (B. S., 1916, Clarkson College of Technology; M.S., 1926 University of Illinois), served as research Assistant in Theoretical and Applied Mechanics here during the year 1919-20.

John Will Harsch, (B.S. in Chem. Eng., 1920, University of Illinois), was Special Research Assistant in Engineering Materials from October, 1920, to February, 1923.

Francis McMurtrie Howell, (B.S., 1917, and C.E., 1918, Northwestern University), served as Special Research Assistant in Engineering Materials here from February 1921, to March, 1923.

Herbert James Gilkey, (B.S. in C.E., 1911, Oregon State College; S.B., 1916, Massachusetts Institute of Technology; B.S., 1916, Harvard University; and M.S. in Mechanics, 1923, University of Illinois), joined the staff at the University of Illinois in February, 1921, as Research Assistant in Theoretical and Applied Mechanics. He was transferred to the teaching staff, however, in that same year with the title of Instructor in Theoretical and Applied Mechanics. He withdrew from the University in September, 1923, to accept a position as Assistant Professor of Civil Engineering at the University of Colorado. Later, he became Head of the Department of Theoretical and Applied Mechanics at Iowa State College.

Jean Paul Leinroth, (M.E., 1912, Cornell University), became Instructor in Theoretical and Applied Mechanics at the University of Illinois in February, 1921, but resigned in February, 1922, to enter engineering practice.

William Ruprecht Osgood, (A.B., 1917, Harvard University; B.S., 1919, Massachusetts Institute of Technology; M.S., 1924, and Ph.D., 1933, University of Illinois) joined the staff here in September, 1921, as Instructor in Theoretical and Applied Mechanics. He remained here until June, 1926, when he withdrew to take a position as Assistant Professor of Structural Engineering at Cornell University.

David Ward Pease, (B.S. in M.E., 1920, University of Illinois), became Instructor in Theoretical and Applied Mechanics in February, 1922, but withdrew in the summer of 1923 to take up practical work.

Cyril Lambert Erickson, (B.S., 1922, University of Wisconsin), was Instructor in Engineering in Beloit College during 1922-23. He then served as Special Research Assistant in Engineering Materials at the University here from July, 1923, to April, 1924.

Irving Fineman, (B.E., 1912, Cooper Union; S.B., 1917, Massachusetts Institute of Technology), spent several years with the Construction Corps of the U.S. Navy, then came to the University in September, 1923, as Instructor in Theoretical and Applied Mechanics. He resigned in June, 1927.

Kenneth Louis Greenan, (B.S. in C.E., 1921, Purdue University), was engaged in Engineering practice until he joined the College staff in September, 1923, as Instructor in Theoretical and Applied Mechanics. Mr. Geenan resigned in June, 1924, to accept an appointment in civil engineering at Rose Polytechnic Institute, While on the way to take up his new duties, his automobile was struck by a train and he was killed.

Edward Franklin Wilsey, B.E., 1922, and M.S., 1923, University of Iowa), was appointed Instructor in Theoretical and Applied Mechanics in September, 1924. He remained in that position until June, 1928, when he withdrew to become Associate Professor of Mechanical Engineering at Roberts College.

Julius Miller, (B.S., 1921, and M.E., 1925, University of Illinois), served as Special Research Assistant in Engineering Materials during 1925-26.

Stuart Wellington Lyon, (B.S. in M.E., 1924, and M.S., 1931, University of Illiniois) was Special Research Assistant in Engineering Materials from May, 1926, to September, 1930, and from September, 1936, to November, 1940. He is joint author of three bulletins issued by the Engineering Experiment Station.

Rolland George Sturm, (B.S., 1924, University of Nebraska; M.S., 1926, and Ph.D., 1936, University of Illinois), became Instructor in Theoretical and Applied Mechanics at the University here in September, 1926. He remained in

that position until June, 1929, when he resigned to enter commercial work with the Aluminum Company of America.

Waldo Edward Smith, (B.E. in C.E., 1923, and M.S., 1924, University of Iowa), became Instructor in Theoretical and Applied Mechanics here in February, 1927, after spending some time in practice in the field of water-supply engineering. He resigned in June, 1928, to become Associate Professor of Civil Engineering at Roberts College.

Joseph Warner Howe, (B.E., 1924, and M.S., 1925, University of Iowa), was Instructor in Theoretical and Applied Mechanics during 1927-29.

Jesse Clarence Ducommun, (A.B., 1926, Morningside College; B.S., 1927, and M.S., 1928, University of Iowa), served as Instructor in Theoretical and Applied Mechanics at the University of Illinois during the school year 1928-29.

Glen Nelson Cox, (B.E., 1925, and M.S., 1926, University of Iowa; Ph.D., 1928, University of Wisconsin), served as Instructor in Theoretical and Applied Mechanics at the University here during 1928-29.

Bernard Breast Betty, (B.E., 1926, Vanderbilt University; M.S., 1930, University of Illinois), served as Special Research Assistant in Engineering Materials from 1930 to 1937. He is co-author of three bulletins issued by the Engineering Experiment Station.

James Ross Trimble, (B.S., 1924, Pennsylvania State College), was Special Research Assistant in Engineering Materials from September, 1933, to May, 1936. Since then he has been associated with the Tennessee Coal, Iron and Railroad Company at Birmingham, Alabama.

Harold Bertram Wishart, (B.S., 1931, and M.S., 1932, University of Illinois), was Special Research Assistant in Engineering Materials from January to November, 1936. Since that time he has served as engineer for the Carnegie-Illinois Steel Company, being at present Supervisor of Research at the Gary Plant.

Francis Louis Ehasz (B.S., 1933, New York University; M.S., 1936, Lehigh University) became Instructor in Theoretical and Applied Mechanics in September, 1938. He resigned in September, 1941.

Keith Carson Lowe, (B.S., 1939, University of Illinois) served as Special Research Assistant in Theoretical and Applied Mechanics from September, 1939, to May, 1941.

Warren Gilbert Dugan, (B.S., 1939, and M.S., 1941, University of Illinois), served as Special Research Assistant on the steel car-wheels investigations from September, 1941 to November, 1942, when he resigned to enter special military work. He died on August 26, 1945. He was joint author of one bulletin published by the Engineering Experiment Station.

Charles Forrest Shriver, (A.B., 1942, University of Illinois), became special Research Assistant in September, 1942, and remained here until September, 1943.

Will Junior Worley, (B.S. in M.E., 1943, University of Illinois), became Instructor in Theoretical and Applied Mechanics in September, 1943, but resigned in September, 1944.

Mehmet Nejat Tokay, (B.S., 1943, University of Illinois), joined the College staff in September, 1943, to give one-half time as Instructor in Civil Engineering and one-half as Special Research Assistant in Theoretical and Applied Mechanics. He resigned in October, 1945.

William Everett Johnson, (B.S., 1937, Georgia Institute of Technology), became Special Research Associate in Theoretical and Applied Mechanics in September, 1943.

Robert Eugene Kraft, (B.S., 1944, University of Illinois), became Special Research Assistant in Theoretical and Applied Mechanics in September, 1943.

<u>Warren Irwin Mitchell,</u>(B.S., 1944, University of Illinois) Became Instructor in Theoretical and Applied Mechanics in February, 1944.

<u>John Calvin Ascherman,</u> (B.S., 1944, University of Illinois), was appointed Special Research Assistant on the cooperative investigation of Reinforced Concrete Footings, beginning September, 1944.

CHAPTER XIV

DEPARTMENT OF ELECTRICAL ENGINEERING

General.- Electrical Engineering as a field of instruction began to be developed here about 1891 as a division of Physics. By order of President Draper, though, the work of Administration and Instruction in Physics and electrical engineering was separated temporarily into two departments upon the resignation of Professor Shea in November, 1895, with Fred A. Sager in charge of Physics and Bernard V. Swenson in charge of Electrical Engineering, at least, for the rest of that academic year.[1] However, in September, 1896, Albert P. Charman became Professor of Physics in charge of both physics and electrical engineering, but in the fall of 1898, the two fields were again separated administratively, this time definitely, and electrical engineering became an entirely independent department of the College with William Esty, Associate Professor of Electrical Engineering in charge. The new Department continued its instructional program on the same high level of performance as that originally established in Physics. It was opening an entirely new province in engineering education, however, and had to make its own experience step by step as the remarkable developments of the industry dictated.

---

1. President Draper had taken up his office only the year before and was making every possible effort to advance electrical engineering as rapidly as possible, for, on account of the increasing demand for men trained in the principles of electricity as it was applied in the design, production, and operation of such electrical equipment as telephone and telegraph apparatus, power plants, and city and industrial systems, it was felt that better educational progress could be made with separate administration.

B. OBJECTIVES OF THE DEPARTMENT

General.- The general objectives of the new department were to provide an adequate and systematic training in the fundamental principles of mathematics and other basic sciences and in the use of English and other languages as well as an essential understanding of the technology of the industry in so far as it had been developed, as a preparation for whatever new advancements the profession might produce.

As stated in a publication issued in 1919, some time after the Department was created, the work of the Department was to prepare men to engage "in the design, care, and maintenance of electrical apparatus of all kinds, the generation and distribution of electrical energy, and its application in the development of power, in lighting and in telegraphy, telephony, and wireless signaling."[1]

C. BUILDING AND ROOM ACCOMMODATIONS

General.- After the Mechanical and Electrical Engineering Laboratory Building was completed in the fall of 1898, the newly-formed Department of Electrical Engineering transferred its laboratory equipment there from University Hall,- the new quarters offering greatly improved opportunities for instruction. At that time, the first or basement floor under the front part of the building contained the calibration room, high-potential laboratory, students' shop, storage-battery room, a stock room, a mechanical-engineering tool room, and a toilet and locker room. The dynamo laboratory and attending apparatus occupied the entire front of the second or main floor and had a clear floor space of 50 by 100 feet, the south end being machinists' and students' work room, instrument rooms, experimental and tool rooms, separated from the laboratory proper by low paneled partitions and wire railings. The third or top floor

1. University of Ill. Bulletin, Vol. XVI, January 6, 1919, No. 19, "The College of Engineering and Eng. Exp. Sta. of the University of Illinois-A Pictorial Description".

contained the large lecture room, special testing and thesis rooms, photometry rooms, and offices. A recitation room, drafting room, seminary room, and the main office remained in Engineering Hall. The drafting room and seminary room ~~were~~ were well lighted and were supplied with every convenience,-the seminary room being accessible to members of the senior class at all times. It contained files of the leading journals of theoretical and applied electricity in English, French, and German, besides a departmental reference library, The Department had, also, six large pier rooms in Engineering Hall that it formerly occupied for advanced electrical and magnetic measurements when it was a division of the Department of Physics.

The 1907-08 issue of the Register stated that the top floor of the Electrical Engineering Laboratory had three recitation rooms, the photometric and telephone laboratories, the reading room for the Electrical Engineering Society, and offices of the Department.

In 1911-12, the rear wing of the Electrical Engineering Labortary Building was remodelled after the University Power Plant was removed to the Mathews Avenue Power Plant Building. The large room thus vacated was divided into two large lecture rooms, two recitation rooms, and one high-tension laboratory.

During 1925-26, Room 207 in the Electrical Engineering Laboratory was converted into a dynamo laboratory, and laboratory classes were scheduled in this room during the second semester of that year. This new laboratory space was made necessary by the increase in enrollment in the Department.

During the summer of 1929, a connecting structure was built across the Boneyard, joining the Electrical Engineering Laboratory and the old laboratory of Applied Mechanics, which was vacated when the Department of Theoretical and Applied Mechanics moved into its new building on the west side of Burrill Avenue. This connecting addition was made to contain four offices, two of which were taken over by departmental offices which were moved from the top floor of the Electrical Engineering Laboratory portion. A large instrument room was provided in this addition or connection, also, for the new hallway passed through the space formerly occupied by the old instrument room.

The front part of the lower floor of the old mechanics building was converted into a dynamo laboratory, and the equipment formerly housed in Room 207 of the Electrical Engineering Laboratory was moved into it. The floor immediately above it was occupied by the radio laboratory and the equipment formerly located in Room 204 of the Electrical Engineering Laboratory was transferred to it. The basement of the old hydraulics laboratory was transformed into research rooms for members of the staff, graduate students, and undergraduate students who were engaged in experimental work requiring individual space. The upper floor of the hydraulics laboratory was converted into a lecture room for general use by the Department of Electrical Engineering or by other departments of the college of Engineering. Seats were provided to accommodate 300 persons and space available for a considerable increase in seating capacity was soon utilized for that purpose.

The rooms on the top floor of the Electrical Engineering Laboratory formerly occupied as departmental offices, were taken over for use as a communications laboratory. The changes made in the office and laboratory arrangement and in the building structure made it desirable to move the 100 kilowatt synchronous motor-generator set from the rear of Room 207 Electrical Engineering Laboratory to the small room containing the 85-kilowatt motor-generator set.

While the changes were being made in the Electrical Engineering Laboratory and the old laboratory of Applied Mechanics, the south end of the old Boneyard Boiler House was converted into a high-voltage laboratory; and the high-voltage transformer and auxilliary equipment formerly housed in Room 206 of the Electrical Engineering Laboratory were transferred to this new location. The removal of the equipment from the back rooms of the Electrical Engineering Laboratory made it possible to assign the space thus vacated to the experiemental activities on high-frequency wave-lengths.

On account of the large student enrollment in electrical engineering and the rapid advances made in the development of science in this particular direction, the Department has been obliged to use practically all of its own space for office and laboratory purposes and to go outside of its building assignments for rooms in which to carry on its class-room exercises.

D. DEVELOPMENT OF ELECTRICAL ENGINEERING LABORATORY FACILITIES

General.- Although very little was known about electricity at the time of the opening of the University three-quarters of a century ago, developments were begun shortly thereafter that have continued at an accelerated rate to the present time. In order to keep in step with practice, the University has throughout the years installed representative types of electrical equipment for the use of students in their laboratory assignments to supplement their regular classroom instruction, whereby they could demonstrate to their own satisfaction the fundamental principles underlying the science involved and study the performance characteristic of typical machines. This equipment, which has consisted of motors and generators, transformers and other power-transmission apparatus, dielectrics, wire and radio communication sets and electronic devices, and a long list of precision instruments for indicating and recording electrical units, and which has enabled the students to attain some measure of proficiency in testing and operating such facilities, is described in some detail in the following pages.

The Power Laboratory.- The electrical-engineering laboratory equipment was greatly extended when it was moved during the summer of 1898 from University Hall into its new quarters in the new Electrical Engineering Laboratory Building. The 1898-99 issue of the University catalogue[1] described the equipment in the dynamo laboratory as follows:

"The dynamo laboratory is equipped with various types of continuous current dynamos and motors, alternators, and transformers, with apparatus and every convenience for making complete tests. Included in the equipment are a 300-light Thomson-Houston alternator, a 40-horse power Westinghouse two-phase induction motor, Brush and Thomson-Houston arc light machines, Edison (two machines), Thomson-Houston, Weston, United States, and other 110-volt dynamos; also two small Westinghouse alternators, and a number of fan and battery motors.

"A marble switchboard, consisting of eight large panels,[2] has been designed

1. Page 84
2. Designed and installed by students.

with special reference to facilitating the work in the laboratory. From it can be distributed to all parts of the building alternating and continuous currents of various electromotive forces.

Connections can easily be made to the various circuits of the University lighting plant, and to the storage battery. There are two large cabinets of instruments for laboratory use. Among these are Weston ammeters, voltmeters, and wattmeters, Whitney, Hoyt & Queen ammeters, Ayrton & Perry ammeters and voltmeters, Cardew & Queen voltmeters, Siemens dynamometers, Kelvin balances, electrostatic voltmeters, Shallenberger, Thomson, and Shaeffer recording meters, hysteresis meters, electrometers, condensers, inductive and non-inductive resistances, lamp, German-silver, carbon, and water rheostats, a Brackett cradle dynamometer, tachometers, revolving contact makers, and other devices and appliances which are essential to the thorough experimental study of direct and alternating currents."

The Register of 1907-08[1] contained the following statement: "The 200-kilowatt power plant of the University located in the Electrical Engineering laboratory, supplies current for department use and affords opportunity for tests. A 40-kilowatt motor-generator set recently installed in the laboratory together with two new experimental switchboards furnish excellent facilities for operating the direct and alternating machines of the department under any specified condition."

A publication issued in 1909[2], stated that in addition to the equipment mentioned in the preceding paragraph, the Department had three rotary converters furnishing current based on 110 and 550 volts direct current; two General Electric stationary-armature alternators designed to operate as either 2- or 3-

1. Page 100
2. "The Engineering Experiment Station and its Relation to Illinois Industries", by L. P. Breckenridge, page 24.

-phase generators or motors at a variety of voltages; a number of 110 and 220-volt direct-current motors of from 10 to 15 horsepower and a variety of direct-current generators of various makes ranging up to 10-kilowatt capacity; several induction motors ranging from 2 to 5 horsepower, of one, two, and three phases, and of various voltages; a single-phase, variable-speed, 220-volt, 10-horsepower, alternating-current motor; and a large number of transformers of various capacities, voltages, and transformation ratios, including a small 10,000-volt, and a 10-kilowatt, 100,000-volt testing transformer. The equipment included, also, switchboards designed for the rapid handling of apparatus, numbrous lamp banks for resistance, oscillographs, inductances, condensers, a mercury-arc rectifier, arc lamps of many types, and many devices used in instructional and research work.

During the next year or so, the Department was able to procure a 125-kilowatt steam turbo-alternator with exciter and switchboard and a self-recording steam flow meter from the General Electric Company. It also was provided with an oscillograph with funds supplied by the Graduate School.

After the Boneyard Power plant was moved out of the rear of the Electrical Engineering Laboratory in the summer of 1911 and the building was remodelled, the two Westinghouse machines that were transferred from the Physical Plant Department to the Department of Electrical Engineering, were coupled together to form an 85-kilowatt motor-generator set to supply direct current for laboratory purposes. In addition, the power switchboard in the main laboratory was enlarged so that the facilities for laboratory work were much improved. In the fall of 1911, the Department received a 2000-cycle alternator,[1] a smooth core alternator, four direct-current motors, and a large number of precision instruments. During 1911-12, two 20-kilowatt Edison bipolar generators were presented to the Department by Mr. F. J. Baker, President of the Public Service Corporation of Northern Illinois.

---

1. The Technograph, December, 1911, page 50.

By June, 1912, the equipment of the Department of Electrical Engineering included the 125-kilowatt turbe-alternator; a 250,000-volt transformer; a 100,000-volt transformer; two 30,000-volt transformers; a smooth-core alternator for generating sine waves; a 2000-cycle alternator; two oscillographs; a 60-cell, 240-ampere-hour storage battery; two motor-generator sets,-one rated at 85 kilowatt and the other at 45 kilowatts; a 10-kilowatt induction furnace; a 30-kilowatt arc furnace; and in addition, a number of meters. A 30-kilowatt Hoskins resistance furnace and transformer owned jointly by the departments of Electrical Engineering and Chemistry, was located in the furnace room and was available for experimental work as well as for instructional use.

In the fall of 1912, the Department received a 50-cycle, 100-kilowatt, 200,000-volt testing transformer with controlling and measuring apparatus, the total equipment weighing approximately 56,000 pounds. The equipment was used to study corona and other phenomena of high-voltage lines in connection with the action of lightning arrestors and other protective devices and in the determination of the break-down point of oil and of various forms of insulators. The equipment was built to order for the University by the General Electric Company, the machine being similar to the high tension transformer used by Doctor Steinmetz in his research laboratory at Schenectady.

During 1920-21, there was added to the equipment a motor-generator set composed of a direct-current, 230-volt, 43.5-ampere motor, direct-connected to a 125-volt, 56-ampere, direct-current generator.

An outdoor substation designed by the General Electric Company as typical of modern practice, was set upon a substantial concrete foundation on the north side of the laboratory building in 1923-24. Three 15-kva, single-phase, 33,000-2,300-volt transformers were used in connection with this substation. Protection was obtained by using oxide film lightning arresters. The station was not connected with any electric circuit, - its purposes being to demonstrate construction processes.

A new Westinghouse 100-kilowatt motor-generator set[1] consisting of a 2 200-volt, 3-phase, self-starting, synchronous motor, and a 220-110-volt, 3-wire, direct-current generator, was installed in the laboratory in 1924. The machine was connected by cable with the Mathews Avenue Power Plant and was used to furnish direct current for the laboratory. It replaced the old 85-kilowatt motor-generator[2] comprised of machines which were formerly used in the Boneyard power plant, as previously mentioned, and which had been used for the ten or twelve years preceding to supply most of the direct current for laboratory use, but which were no longer of sufficient capacity to meet the needs of that time.

A new Reliance[3], variable-speed, direct-current, motor was added to the list of equipment during 1924-25. The most unusual feature of the machine was its method of speed control. The speed, which could be varied from 200 to 1600 r.p.m., was changed by sliding the motor along its axis of rotation into or out of the magnetic field set up by the field windings. The motor was used to drive a new 3-phase alternator capable of delivering power at 110 volts, 25 cycle; 220 volts, 60 cycle; and at any other frequency between 10 and 80.

A new motor-generator set was installed in the alternating-current laboratory in 1926-27. This consisted of a direct-current motor driving a 125 k.v.a. alternator. Leads were brought from the armature windings of the alternator, so that any number of phases from one to twelve could be tapped off.

Other new equipment added from time to time included a number of storage batteries, small motors, generators, and standard types of motor-generator and rotary-converter sets, autotransformers, constant-current transformers, regulators, rectifiers, capacitors, reactances, meters, potentiometers, oscillators, cathode-ray oscillographs, tachometers, slipmeters, and stroboscopes.

1. The Technograph, January, 1925, Page 91.
2. This set was about twenty-five years old at that time and was no longer reliable, but was retained, however, as an auxilliary emergency unit. It still remains in position in 1945.
3. The Technograph, March, 1925, Page 141.

After the building had been remodelled in 1929, and considerable laboratory space had been added thereby, the Department was able to provide several new pieces of typical equipment such as motor-generator sets of various capacities, generators, motors, voltage regulators, transformers, meters, and other auxilliary appliances. The stock was enlarged from time to time after then as funds allowed until in 1945, the dynamo and motor laboratories contain representative motors and generators of every standard type, ranging in size from those of fractional horsepower to those of 15 and 25 horsepower, and control equipment for studying the operation and characteristics of any of these machines. The apparatus includes direct-current motors and generators, synchronous motors and generators, single-phase commutator motors, variable- and multiple-speed alternating-current motors, synchronous converters, motor-generator sets, transformers, regulators, rectifiers, and storage batteries,-all selected to conform to the best standards of practice prevailing in industrial use and in the leading commercial laboratories of the country.

Storage-Battery Laboratory.- A publication[1] issued in 1907 stated that the Department had a 60-cell Gould storage battery of 240 ampere-hours capacity with a switchboard so arranged that all voltages between 2 and 120 could be obtained. There could be provided current up to 100 amperes at full voltage and greatly-increased current at lower voltage. Another storage battery with a capacity of 240 ampere-hours capacity was added in the early part of 1912-13. Similar provisions have been made since then as conditions seemed to justify them. Thus, from time to time since the Department was organized, the laboratory has been supplied with such batteries and auxilliary appliances as seemed essential to carry on the instructional and experimental programs established in line with the progressive College policy.

1. "The College of Engineering of the University of Illinois," page 9. See also a publication entitled "The Engineering Experiment Station and its Relation to Illinois Industries", 1909, by L. P. Breckenridge, page 24.

Calibration or Standardization Laboratory.-As early as 1898, the standardizing laboratory, located on the ground floor of the Mechanical and Electrical Engineering Laboratory Building, was equipped for measuring accurately current and electromotive force, thus permitting at all times, ready calibration of the instruments used in the laboratory. A publication[1] issued in 1909 stated that the Department had provided "a fine set of standard electrical measuring instruments including a Weston D. C. laboratory standard voltmeter and a milivoltmeter, Westinghouse precision voltmeter, ammeter and wattmeter and a Leeds and Northrup potentiometer."

The laboratory was remodelled from time to time, as previously stated, and in 1924-25, a new calibration laboratory was set up in Room 305 of the Electrical Engineering Laboratory Building. Then, in 1926-27, Room 205, Electrical Engineering laboratory was converted into a standards laboratory. Various standard instruments used for accurate calibration of different types of meters, were placed in this room. Much work was done by N.Y.A. students during the years 1935-40 in building storage cabinets, benches, and in repairing and rebuilding and calibrating electrical instruments for this laboratory. Other improvements were added as conditions permitted so that in 1945, the calibration laboratory is provided with a great variety of apparatus for accurate calibration of electrical instruments used for instructional and experimental purposes,-that is, for measuring resistances, inductances, and capitances; and potentials, current, and power. This precision equipment consists of such devices as standard cells, certified resistances, potientiometers, shunts, bridges, voltmeters and millivoltmeters, ammeters, and wattmeters.

Wire Communication Laboratory.- In 1898, an experimental telephone and signaling line was erected on the third floor of the Mechanical and Electrical Engineering Laboratory, and several sets of manual and automatic receivers and transmitters were provided for testing purposes. Cables, coils, batteries, and instruments were added from time to time to keep pace with improvements in commercial service. The Register of 1907-08 contained the following statement: "Two rooms...

---

1. "The Engineering Experiment Station and its relation to Illinois Industries," by L.P.Breckenridge, page 25.

are furnished with special 100-line switchboards, and with cables, coils, batteries, and instruments to illustrate recent practice in telephony and telegraphy, as well as to provide for the rapid comparisons required for telephone experiments".[1]

The first step in building up the present telephone laboratory was the design and construction of a terminal board for an artificial line which the Department had acquired as a gift from the Bell Telephone System in 1924,- the gift including an artificial line simulating about 200 miles of open-wire type of line together with an oscillator yielding frequencies from 100 to 50,000 cycles per second, and a number of instruments useful in making tests on the artificial line for the study of telephone circuits and problems relating to long-line telephone communication. Additional design and construction work was done by electrical engineering students as a special problem in E.E. 72, "Special Electrical Engineering Problems", when instructional work in wire communication was begun in 1930 under this course. The Western Electric Company donated the Department a length of 600-pair lead sheath telephone cable, which was installed on the roof of the connection which was built between the old Electrical Engineering Laboratory Building and the old Laboratory of Applied Mechanics when the two were made into one structure. This cable is approximately 150 feet in length; but by using a system of interconnecting paris, it is possible to get for experimental purposes the equivalent of a single pair twelve miles long. Thus in 1936, the laboratory had available for instruction and research the equivalent of a cable-pair line twelve miles in length of the twisted-wire type. Another piece of equipment built by the Department for use in this connection, was a cathode-ray oscillograph. During the years from 1931 to 1936, the Department received from the American Telegraph and Telephone Company by gift much valuable equipment, some of which was used as received and some was rebuilt into more effective pieces for departmental use.

1. page 100

Other equipment procured or made by the Department about this time under the immediate direction of Professor C.E. Skroder, who was and still is in charge of this division, included a telephone repeater, a transmission measuring set, parts of automatic telephone switching and dialing line systems, vacuum - tube voltmeters and millammeters, together with such appliances as jack boxes, switch boxes, transformers, networks, amplifiers, loud speakers, and miscellaneous apparatus. Additional facilities added from time to time consist of retard coils, loading coils, telephone transformers, condensers, repeaters, filters, impedance bridges, audio-frequency oscillators, relays, transmission measuring sets, and vacuum-tube devices, and other instruments for measuring currents and voltages for telephone frequencies.

Electronics Laboratory.- Work in a special division of electronics was begun about 1933-34, when the Department began the development under the immediate direction of Professor H. J. Reich, of an electronics laboratory to carry on instructional and experimental studies along such lines as electronic light sources, thermionic emissions, photoelectric effects, gas-discharging phenomena, ionization, and high-vacuum tubes. The N.Y.A. students in 1935-37 did a great deal of work in preparation of the electronics laboratory by assembling speed meters, lecture-demonstration equipment, and such laboratory apparatus as speech scramblers, volume expanders, power amplifiers, and cathode-ray oscilloscopes. Other equipment provided from time to time includes electrometers, vacuum-tube voltmeters, audio-frequency bridges, oscillators, photoelectric and photronic tubes, ignitrons, single-phase and multiple-phase tubes, detectors, rectifiers, sound transmitters, amplifiers, special tubes, and other electronic devices used in power conversion, industrial control, and radio operation.

Radio-Communications Laboratory.- About 1920-21, radio apparatus designed and assembled by members of the Department of Electrical Engineering, was installed in the radio laboratory at the north end of the top floor of the Electrical Engineering Building for instructional and research work in the radio field. An aerial was mounted on separate supports between this building and the old Boiler

House. In March, 1922, a commercial broadcasting license was granted by the Federal Government permitting the University to broadcast from this station. The broadcasting was done with a wavelength of 360 meters through the agency of a transmitter consisting of two 50-watt oscillator tubes in parallel, giving an output of 100 watts, and modulated with two 50-watt tubes in parallel. Two regular programs a week and many special programs including University news items, brief speeches by prominent University Officials, musical programs, athletic games, etc., were presented. A special circuit installed to connect the radio laboratory with Smith Music Hall, was extended to the University Auditorium. The sending range of the station for telegraphic messages was about 1000 miles, although the set could receive messages from Old-World stations.

During the year 1922-23, the Department designed more powerful broadcasting apparatus using 500 watts, modulated by three 250-watt modulator tubes in parallel.

A universal wave meter, with a range of 80 to 24,000 meters, power generator vacuum tubes, and Kenetron rectifier tubes were installed in the radio laboratory during the early part of 1921-22. A 200-volt vacuum tube, radio phone was produced in the early part of 1921-22. A new 200-volt storage battery was installed for laboratory work and for power amplification in the broadcasting set in 1924.

In 1926-27, the Department received one Universal Precision wavemeter with a range from 75 to 24,000 meters, two radio-frequency thermo-voltmeters, and three "B" battery eliminators.

In 1930-31, a complete 40-meter, 500-watt amateur transmitter was constructed and put into operation in the radio laboratory, which made possible amateur communication with other stations at near and at distant points. Communication by telegraph code was maintained with amateurs in the Hawaiian Islands during the early evenings. The station was duly licensed as an amateur station in charge of Professor H. A. Brown, who, himself, had an amateur radio operator's license, and who was then and continued to be in charge of this division, unitl his death in February, 1945.

A radio communications laboratory, containing the equipment of the University short wave station W9YH (80 m, 3938 kc, 250 watts) was in operation in 1933-34. A 250-watt television transmitter and a group of wave meters, condensers, oscillators, and other apparatus for the study of the principles of radio communication wereavailable.

Little by little, the laboratory equipment, built up for instructional and experimental purposes in the field of radio communciation, came to include apparatus for transmission and reception; television; and high, medium, and short-wave frequencies. Among the facilities are such devices as microphones; oscillators; power amplifiers; loud speakers; modulators and demodulators; detectors; short-wave and ultra-high frequency and television transmitting and receiving sets; transformers; photo-electric cells; piezelectric apparatus; and high-frequency measuring sets and standards.

Radio-Transmission Laboratory.- The construction of the new studio for the University Broadcasting Station made available the old studio and towers at the south end of Illinois Field for use by the Department of Electrical Engineering for instructional and research purposes. After this old studio had been assigned to the Department, certain equipment formerly housed in the Radio Measurements Laboratory, was moved into it. In addition, the old 1,000-watt transmitter originally used in W-I-L-L was installed there. This additional space and equipment, together with the transmission towers, afford unusual facilities for both instructional and experimental purposes. This plant has been designated as the Radio-Transmission Laboratory.

High-Potential Laboratory.- In 1898, the high-potential laboratory was located on the ground floor of the Mechanical and Electrical Engineering Laboratory. The equipment included a high-potential transformer, with a specially-designed electrically-heated oven, and other accessory apparatus, to facilitate disruptive tests on insulators and insulating or dielectric materials.

A 12-foot induction transformer coil,-Tesla coil,-was constructed during 1914-15 under the supervision of R.E.Hart, 1915, for study of the behavior of

high-voltage circuits and dynamic arcs. The coil could generate 2,500,000 volts, and could produce a spark ten feet long. After the remodelling of the space vacated by the removal of the old power units in the east wing of the Electrical Engineering Laboratory, the coil was located in one of the rooms of this wing.

A new Tesla transformer coil was built in 1921-22, with a spark-gap capacity of 9 feet for the study of special problems relating to radio communication and spark-gap performance. The coil was 10 1/2 feet long and held 1,800 turns on the secondary winding giving 25,000 volts on the secondary; and by using a special glass condenser, the resulting spark could be caused by a potential drop of several million volts.

During the year, 1926-27, Room 206 of the Electrical Engineering Laboratory, formerly a classroom, was converted into a combined radio and high-voltage laboratory. The high-voltage transformer was moved into this room along with the radio-laboratory equipment.

When the old Boiler House was remodelled in 1929, the south half of the building was transformed into a high-voltage laboratory, and the high-tension equipment was moved into it from Room 206 of the Electrical Engineering Laboratory. New apparatus was added from time to time until in 1945 the facilities include transformers, high-voltage rectifiers, surge-voltage recorders, shpere-gap voltmeters, a surge generator which can develop an impulse potential of 300,000 volts, a power-factor bridge, an ionization-discharge bridge, and a high-quality wave-form k.v.a. motor-generator,- all devoted to investigational work in high-tension circuits. A new Tesla transformer coil, built during 1939-40, developing alternating current with a potential of 1,500,000 volts, became available for the further study of high-voltage, high-frequency phenomena in the field of electronics and radio engineering, and of investigations concerned with transmission-line equipment, insulation materials, corona effects, and spark-over performance.

Illumination and Photometry Laboratory.- The following description of the illumination and photometry equipment appeared in the 1898-99 issue of the University Catalogue:

"The photometry rooms are supplied with two electric light photometers, one of which is the latest type of Kruess-Bunsen apparatus fitted with a standard Hefner lamp and various accessories. There are numerous types of incandescent lamps and of continuous and alternating arc lamps; and various conveniences for making candle power, life, and efficiency tests are provided."

In 1905-06, one of the rooms located on the top floor of the Electrical Engineering Laboratory, was equipped as a photometry laboratory. At that time, facilities consisted of two photometers and display-lightning apparatus for conducting tests and for making practical comparisons of the various forms of gas and electric lamps. Another photometer was added within a year or so.

A statement from a publication[1] issued in 1909 indicated that the laboratory had a ~~three~~ 3-meter and a 5-meter photometer bar, photometers of various kinds, standard lamps, and a Sharp Millar illuminometer.

The first courses devoted entirely to illumination were offered in 1931-32. During that year, classes were held in the Little Theater in Lincon Hall because the room had a stage equipped with lighting fixtures of the modern type. A portable demonstration cabinet was built for use on this stage. During the summer of 1932, however, facilities were provided on the engineering campus when the south half of the former Fatigue-of-Metals Laboratory in the old Boneyard Boiler House known by that time as the Electrical Engineering Annex, was remodelled to form a light-tight room for class and demonstration purposes in illumination. The equipment installed in the new location at that time or shortly thereafter included several varieties of lighting fixtures, sign-demonstration panels, show-window and other lighting demonstration cabinets, demonstration fixtures for direct and indirect lighting, mercury-vapor and other forms of lamps, colored lights, and flourescent lighting appliances. The room was arranged to seat fifty students regularly and could be equipped to seat a hundred for special lectures. A projection lantern was provided and a collection of slides accumulated that illustrated the principles of modern illumination covering the fields of railroad, street, sport, field, fountain, airport, airway, and general flood lighting.

1 The Engineering Experiment Station, and its relation to Illinois Industries" by L.P.Breckenridge, page 25.

During the summer and fall of 1936, the room occupied by the Illumination Laboratory was again remodelled by providing it with a new floor and ceiling, and a fire escape, ventilating system, and other accommodations. Additional equipment was installed that had been given to the University by the various commercial agencies interested in this particular phase of engineering. The room, provided with a floor space of 52 feet by 37 1/2 feet, was finished with plaster ceilings, side walls, demonstration counters, a demonstration stage, and a storage space.

In 1937, the Physical-Plant Department arranged to move its store room under the illumination laboratory to other quarters and to convert the space thus vacated, 52 feet by 52 feet, into a photometry laboratory, During the next year or two the room was supplied with modern equipment; so by that time, the Department had the most outstanding illumination and photometric laboratory of any school in this country.

One unusual piece of equipment installed during 1938-39 is an icosahedron photometer with a diameter of 10 feet, designed and constructed under the supervision of Professor Kraehenbuehl, who is in charge of this division, that makes possible the measuring of output of lighting equipment and the testing of commercial lighting fixtures. This is a rather unusual piece of apparatus found in only a few laboratories. Other facilities installed in the photometric laboratory include a 60-inch sphere photometer for the measuring of lamps and the checking of measuring equipment; a visibility meter used for research on writing boards and other facilities; a contrast sight box; a projection foot-candle meter used for demonstrations; a large distribution photometer; and a writing board machine for study of depreciation of writing boards in research. In 1940, funds were made available by the Graduate School for the purchase of a General Electric automatic recording spectrophotospectrometer with a special reducing lens for use in making color analysis of small specimens. The instrument is being used not only by Electrical Engineering, but also by many other departments on the campus. There was also received in 1939-40 a Gaertner quartz monocrometer with an extra flint-glass prism. During this time, there was

constructed in the departmental shop a 10-foot distribution photometer, a chalkboard testing machine, a 15-foot special bar photometer with reflecting and transmission distribution attachment. The addition of all this new equipment has served to keep this laboratory in the forefront of other corresponding installations in American colleges.

Meter and Relay Laboratory.- With the organization of the short course for electric metermen in 1920, under the immediate direction of Professor A. R. Knight, the Department gave special attention to the problems of electric recording watt-hour meters and relays. From that beginning, the work, developed little by little, year by year, in connection with the short courses that were conducted, together with the reports, papers, and bulletins prepared by members of the staff, attracted favorable attention of the various meter-manufacturing companies. As a result, the meter-manufacturing companies cooperated heartily in furnishing equipment and materials for conducting research in these fields, with the results that the Department had developed by 1936 an outstanding laboratory for the study of meter and relay problems, much of the work in preparation of demonstration panels, repairing meter and relay equipment, repairing work tables, control boards, having been done by N.Y.A. students during 1935-36. During the next two years, the Department received by gift from a number of companies and by purchase, an assortment of different types of meters and relays for use in this laboratory.

Gradually, the list of equipment was extended to include a liberal assembly of electro-magnetic and vacuum-tube relays, watt-hour meters, wattmeters, ammeters, voltmeters, frequency meters, power-factor meters, oscillographs, oscilloscopes, and other instruments devoted to measuring and recording the energy demanded and consumed in the operation of power, transmission, and communication systems.

Electric Railway Laboratory.- The electric railway laboratory was transferred to the Department of Electrical Engineering when the Department of Railway Engineering was dissolved in 1940. Because most of its history is associated with the Department of Railway Engineering, the description of the equipment is related under a heading under that department.

The Electric Railway Test Car.- In 1905, the Department secured and equipped an electric test car of the interurban type designed by members of its own staff, which the students and instructors used for making test runs on the city and interurban lines of the Illinois Traction System. Later, the car was transferred to the Department of Railway Engineering, and is described more fully under that department.

University Light and Power Plant.- The 1898-99 issue of the University Catalogue stated that the electrical equipment[1] in the University Light and Power plant was available for tests by the Department of Electrical Engineering. It consisted of two Westinghouse, 2-phase, alternating-current dynamos, one of 75-kilowatt and one of 45-kilowatt capacity; a 30-kilowatt, 500-volt, constant-potential generator; a Wood series arc-light machine for lighting the campus grounds and Military Hall; and a number of induction motors.

A circular issued by the University in 1903, described the electrical equipment in the Central Heat, Light, and Power Plant, as it called it, as composed of one 120-kilowatt, 440-volt, 2-phase, alternator, direct connected; one 75-kilowatt, 440-volt, 2-phase alternator; one 25-kilowatt Wood arc-light generator; and eight induction motors. After the Mathews Avenue Plant was opened in 1911, the central-station facilities were not so readily available for departmental use.

E. MISCELLANEOUS

Damage Due to Flood.- Early in July, 1929, while the outside walls of the Electrical Engineering Laboratory were boken by workmen during construction changes, the Boneyard rose sufficiently high to flood the basement of the building to a depth of three and a half feet. Flood waters entered the building on two successive days, and caused damage to electrical equipment, water-soaking many electrical machines and instruments, and entirely submerging the storage battery. The estimated amount of damage due to flooding was $1425. The Board of Trustees on December 9, 1930, made a special appropriation to cover this damage. It was found out afterwards, however, that several pieces of apparatus

1. All of this equipment is described further in a later chapter of this publication.

had insulation so weakened by water that they broke down in service during the school year. Thus, the total damage to the equipment was greater than the amount for which special appropriation was made.

Movietone Projector.- During the school year 1933-34, the College of Engineering was offered a movietone projector by the General Electric Company. The equipment had been used to some extent, but it was in excellent condition, and was offered to the College at a cost which was only a small fraction of the original price. The equipment, purchased with general College funds, was installed in the general assembly room in the Electrical Engineering Building, where it could be used for freshmen lectures and such general lectures as used the talking films.

Joint Meetings of the Student Branches of the American Institute of Electrical Engineers of Purdue, Rose, and Illinois.- A joint meeting of the electrical engineering societies at the University and student branches of the American Institute of Electrical Engineers at Purdue University and Rose Polytechnic Institute was held at Urbana, on April 20, 1929. This was the first attempt at a joint meeting of these three groups. About thirty persons from Purdue and twenty-five from Rose were present. Such meetings gave students and faculty an opportunity to discuss their common problems and to become familiar with equipment and methods of instruction used in other institutions.

On April 12, 1930, a similar joint meeting was held at Purdue University. Thirty-three students in electrical engineering and nine members of the faculty at Illinois attended this session. A third meeting was held at Rose Polytechnic Institute on April 18, 1931. There were fifty representatives at the meeting from Illinois, several of whom were faculty. One feature of this meeting was an inspection trip to a major electrical power generating station recently put into operation on the bank of the Wabash River in Terre Haute, using coal mined on the spot as fuel supply. Arrangements were made for students to enter the mine so that they could become familiar with the methods used in bringing the coal to the power house and converting its energy into the form of electricity for distribution into the transmission system which linked the middle-west States.

These meetings were considered so beneficial that they have been continued to this day, each of the three schools taking its turn at being host.

Conference of Student Branches of the Great Lakes District of the A.I.E.E.- The ~~Great Lakes District,~~ Committee on Student Activities of the American Institute pf Electrical Engineers of the Great Lakes District, met at the University on April 22, and 23, 1938, with faculty counselers and incoming student chairmen from 15 of 17 schools attending as delegates. The 17 schools includd Iowa State College, University of Detroit, University of Michigan, Armour Institute, University of Wisconsin, Michigan State College, Marquette University, Michigan College of Mining and Technology, University of Iowa, Purdue University, University of Minnesota, Lewis Institute, Rose Polytechnic Institute, Northwestern University, Notre Dame, Milwaukee School of Engineering, and University of Illinois. The attendance on the first day was 87. The tri-school meet,- Purdue, Rose, and Illinois, was held on April 23, to make the total attendance on that day 110.

F. FACULTY PERSONNEL

General.- Short biographical sketches of members of the staff above the grade of assistant that have been connected with the Department of Electrical Engineering, are listed in the following pages in chronological order accoring to rank.

a. HEADS OF THE DEPARTMENT

General.- The following persons served as heads of the Department of Electrical Engineering after its work was separated administratively from Physics in 1898: William Esty from 1898 to 1899, William Sleeper Aldrich from 1899 to 1901, Morgan Brooks from 1901 to 1909, Ernest Julius Berg from 1909 to 1913, Ellery Burton Paine from 1913 to 1944, and William Littell Everitt from 1944 to date. Biographical sketches of these men follow.

William Esty, was born on July 9, 1868, at Amherst, Massachusetts. He received the A.B. degree at Amherst College in 1889, the B.S. degree at Massachusetts Institute of Technology in 1893, and the A.M. degree at Amherst in 1893. After engaging in engineering practice for a time, Mr. Esty came to the University of Illinois and served as Instructor in Electrical Engineering in the Department of Physics during 1893-95, Assistant Professor in the same department during

1895-98, and Associate Professor in the Department of Electrical Engineering during 1898-01, being in charge of the Department during 1898-99. He resigned in 1901 to accept a position at Lehigh University, and later became Head of the Department there. Professor Esty is author of a text entitled "Alternating Current Machinery", published by the American Corresponding Schools and is co-author with W.S.Franklin of "The Elements of Electrical Engineering", Vol. I, and Vol. II; with W. S. Franklin, C.E. Clewell, and S.S. Seyfeit of "Dynamo Laboratory Manual"; and with W.S. Franklin of "Dynamos and Motors".

William Sleeper Aldrich was born in Philadelphia on March 3, 1863. He received the M.E. degree from Stevens Institute of Technology in 1884, and taught in secondary-school work during 1884-89. He was Instructor in Johns Hopkins University during 1889-91 and Associate there in 1891-92. After serving as Professor of Mechanical Engineering and Director of Mechanic Arts at the University of West Virginia during 1893-99, he became professor of Electrical Engineering and Head of the Department at Illinois in 1899, resigning, however, in 1901, to become Director of Clarkson Memorial School of Technology, at Potsdam, New York.

Morgan Brooks was born in Boston, Massachusetts, on March 12, 1861. He was graduated from Brown University in 1881 with the Ph.B. degree and from Stevens Institute of Technology in 1883 with the M.E. degree. He was engaged in engineering practice during 1883-1898 and was Professor of Electrical Engineering at the University of Nebraska during 1898-1901. In 1901, he joined the faculty of the University of Illinois as Professor of Electrical Engineering and remained with the University until 1929, being Head of the Department during 1901-09. He reached the University's age limit on September 1, 1929, and was retired with the title of Professor of Electrical Engineering, Emeritus, and for some time continued to make his home in Urbana. Professor Brooks is co-author of one bulletin published by the Engineering Experiment Station.

Ernest Julius Berg was born in Ostersund, Sweden, on January 9, 1871, and was graduated in mechanical engineering from the Royal Polytechnical Institute in Stockholm in 1892. He came to this country in 1893, and joined the staff of the Thompson-Houston Electric Company, and after a year, went with the General Electric company, serving that organization first as practicing and later as consulting engineer. He had a leading part in the invention and development of various electricl

machines and instruments manufactured by the General Electric Company, and was frequently called into consultation by other electrical experts in this country and abroad. He designed and personally installed in 1897 the first rotary transformer in Chicago. In addition to his duties with the General Electric Company, he served as special lecturer in Union College during 1906-09 and at the end of that time was awarded there the honorary degree of Doctor of Science. On November 17, 1909, Doctor Berg left the General Electric Company to become Head of the Department of Electrical Engineering at the University of Illinois. As the salary received by him from the company was substantially more than the University did or could pay its professors, his coming was made possible only by the fact that several large Illinois corporations interested in electrical matters, at the solicitation of Dean Goss, supplemented the University salary by giving Doctor Berg a retaining fee as consulting engineer, partly to have an outstanding electrical expert within easy call, and partly as a testimony of their interest in engineering education and particularly in the development of the electrical engineering department of the University.

Doctor Berg was a likable and hospitable man, and had a keen mind, magnetic personality, and a broad experience. He was a valuable and stimulating member of the teaching staff, and particularly of the Senate Committee on University Policy as he threw light upon many problems from a new angle. He aroused the intense enthusiasm of his students and of the instructors on the departmental staff. It was currently reported that the students would "work their heads off for Doctor Berg". He created a great interest among his graduate students in the study of advanced physics and higher mathematics. He was the author of a text-book entitled "Electrical Energy". He made many contributions to the Proceedings of the American Institute of Electrical Engineers and other publications. Dean W. F. M. Goss writing of him in the Technograph[1] stated: "Doctor Berg's experience in designing, building, installing, and operating electrical machinery permits him to deal with the more practical problems of his profession with a degree of enthusiasm that is well-nigh irresistable, and the fact that he has achieved success in advancing the more theoretical phases of electrical engineering is inspiring to those who are interested in the development of problems through mathematical processes. As

1. Vol. XXIV, 1909-10.

a close personal friend and for many years a co-worker with the celebrated Doctor Steinmetz, Doctor Berg has kept in touch with the best thought in his field and has had a part in its development."

For family reasons, he resigned his position here in June, 1913, and returned to the services of the General Electric Company and to Union College, much to the regret of all connected with the University. He continued with both organizations until he retired in 1941, passing away on September 9 of that year.

Ellery Burton Paine was born on October 9, 1875, at Willington, Connecticut, and obtained the B.S. degree at Worcester Polytechnic Institute in 1897, the M.S. degree there in 1898, and the E.E. degree in 1904. He was employed with the General Electric Company during 1898-99, and served as Electrical engineer for the Lehigh Coal Company during 1899-02. He was Dean of the College of Technology and Engineering, Stetson University, Florida, during 1902-04, and Professor of Electrical Engineering and Physics and Head of the Department, at North Carolina College of Agriculture and Mechanic Arts during 1904-07. He came to the University of Illinois in 1907 as Assistant Professor of Electrical Engineering. Following the resignation of Doctor Berg in 1913, Professor Paine became Acting Head of the Department of Electrical Engineering, and later became Head, and retained that position until September, 1944, when he reached the University age limit and was retired with the title of Professor of Electrical Engineering, Emeritus. He is co-author of three bulletins of the Engineering Experiment Station.

Professor Paine did an excellent service in directing the affairs of the Department. He knew his students and alumni intimately and was deeply interested in their success. He maintained a close contact with the advances in industry in the electrical field and gave the Department the benefit of such experience. He was a competent administrator and an excellent teacher and counselor. Naturally, the facilities and instructional standards continued to improve during his tenure of service, keeping the Department well to the front among those of its kind in other schools.

William Littell Everitt was born at Baltimore, Maryland, on April 14, 1900, and was graduated from Cornell University in 1922 with the degree of Electrical Engineer. He received the M.S. degree from the University of Michigan in 1926 and the Ph. D. degree from Ohio State University in 1933. Dr. Everitt was on the teaching faculty at Cornell from 1920 until 1922, at the University of Michigan from 1924 until 1926, and at Ohio State from 1926 until September, 1944, when he became Professor of Electrical Engineering and Head of the Department here. He has had extensive engineering experience in industry having been on leave from his teaching work to serve as Chief of Operational Research in the office of Chief Signal Officer of the U.S. Army Signal Corps from 1942 until he assumed his duties here on May 1, 1945.

Professor Everitt is author of a textbook entitled "Communication Engineering" and is co-author and editor of another one entitled "Fundamentals of Radio". He is also author of a section on Telegraphy and Telegraphy in the "Standard Handbook for Electrical Engineers". He is author, in addition, of many articles in the engineering press and is co-author of one bulletin issued by the Ohio State Engineering Experiment Station. Doctor Everitt was honored by being elected President of the Institute of Radio Engineers for 1945.

b. OTHER PROFESSORS

Joseph Tykocinski Tykociner, (E.E., 1901, High Technical Institute at Cothen, Germany), was employed for a number of years in engineering practice in Europe and the United States. He came to the university of Illinois in September, 1921, as Research Assistant Professor of Electrical Engineering, and was made research Professor of Electrical Engineering in 1929. He is author of one bulletin and joint author of eight additional ones, and is joint author of one circular issued by the Engineering Experiment Station. Professor Tykociner has had a large part in the development of sound in the moving picture industry. His work has been outstanding in its field and has brought much prestige to the University.

Abner Richard Knight, (M.E., 1909, Ohio State University; M.S., 1917, and E.E., 1922, University of Illinois), was engaged in electrical engineering practice during

1909-11. He served as Instructor in Electrical Engineering at the University of Pennsylvania in 1911-13. He came to the University of Illinois in 1913 and served successively as Instructor, Associate, Assistant Professor, and Associate Professor of Electrical Engineering until 1931. Since that time he has been Professor of Electrical Engineering. Professor Knight is joint author of one bulletin issued by the Engineering Experiment Station, and is co-author of a textbook entitled "Introduction to Circuit Analysis". Upon the retirement of Professor Paine in September, 1944, Professor Knight was appointed to serve ad interim as Acting Head of the Department.

Hugh Alexander Brown, (B.S., 1911, M.S., 1914, and E.E., 1920, University of Illinois), taught two years as Instructor in Electrical Engineering at the University of Arkansas, one year as Instructor in Signaling in the School of Military Aeronautics at the University of Illinois, one year as Instructor at Pennsylvania State College, and came to the University of Illinois in September, 1920, as Instructor in Electrical Engineering. He was made Associate in 1921, Assistant Professor in 1925, Associate Professor in 1937, and Professor of Electrical Engineering in 1939. Professor Brown was author of a textbook entitled "Radio Frequency Electrical Measurements", and was joint author of five bulletins issued by the Engineering Experiment Station. He was closely associated with radio development and with radio activities on the campus until his death on February 25, 1945.

John Otto Kraehenbuehl, (B.S. in E.E. and also M.E., 1917, University of Tennessee; M.S., 1922, and E.E., 1926, University of Illinois), He was engaged in engineering practice during 1917-20. He became Instructor at the University of Tennessee and served in that capacity during 1921-22. He then came to the University of Illinois and served successicely as Instructor, Associate, Assistant Professor, and Associate Professor from 1922 to 1939. Since 1939, he has been Professor of Electrical Engineering. He is co-author with Professor Max A. Faucett of "Machines in Electrical Engineering", of "Circuits in Electrical Engineering", and of "Circuits and Machines in Electrical Engineering", and is author of "Electrical Illumination". He is co-author of one bulletin and is the author of two circulars of the Engineering Experiment Station.

Herbert Joseph Reich, (M.E., 1924, M.S. in Physics, 1926, and Ph.D. in Physics, 1928 Cornell University), was Instructor in Machine Deisgn at Cornell during 1924-25, and Assistant in Physics and Instructor in Physics there during 1925-29. He came to the University of Illinois in 1929 and served as Assistant Professor of Electrical Engineering until 1936 and Associate Professor from 1936 to 1939. Since 1939, he has been Professor of Electrical Engineering, although he has been on leave of absence for war service since January 1, 1944, with the Radio Research Laboratory at Harvard University.[1]

Professor Reich is the author of the text,"Theory and Application of Electron Tubes". He has written extensively for the leading scientific journals and has designed and invented numerous electronic devices.

Charles Alva Keener, (B.S., 1919, University of Kansas; M.S., 1920, Massachusetts Institute of Technology; and E.E., 1929, University of Illinois), joined the staff at the University of Illinois in September,1929, as Instructor in Electrical Engineering. He became Associate in 1927, but left the University in 1929 to engage in electrical-engineering practice for one year. He returned in September, 1930, with the title of Assistant Professor. He was made Associate Professor in 1937, and Professor in 1943. He is joint author of two bulletins of the Engineering Experiment Station.

c. ASSOCIATE PROFESSORS

Edward Hardenbergh Waldo, (A.B., 1888, Amherst College; M.E., 1890, Cornell University; and M.S., 1913 and E.E., 1917, University of Illinois), was employed in engineering practice during 1890-93, and was Instructor in Electrical Engineering at the University of Pennsylvania during 1894-1904. After three years' experience in practice again, Mr. Waldo came to the University of Illinois as Assistant Professor of Electrical Design. He became Associate Professor of Electrical Engineering in 1931 and remained with the department until he reached the University age limit on September 1, 1934, when he was retired with the title Associate Professor of Electrical Engineering, Emeritus.

Ernest Alexander Reid, (B.S., 1911, Mississippi Agricultural and Mechanical College;

1 Professor Reich resigned on September 1, 1945, to accept a position at Yale

B.S., 1914, M.S., 1915, and E.E., 1927, University of Illinois), joined the College staff here in September, 1917, as Instructor in Electrical Engineering, after two years' teaching experience at the University of Minnesota and one year in practice. He became Associate in 1920, Assistant Professor in 1923, and Associate Professor in 1931, and has remained with the University to date (1945).

John Kline Tuthill, (B.S., 1914, and E.E., 1925, University of Illinois), was engaged in engineering practice for a number of years before he joined the University of Illinois School of Military Aeronautics in 1917. He served as Instructor in this work during 1917-18, and then returned to practice. In September, 1920, he became Research Associate in Railway Electrical Engineering in the Department of Railway Engineering, and Assistant Professor in 1921. He was made Associate Professor in 1932. When the Department of Railway Engineering was dissolved in 1940, Professor Tuthill was assigned to the Department of Electrical Engineering to teach electrical and railway electrical subjects. He is author of a textbook entitled "Transit Engineering". For the last several years, Professor Tuthill has had charge of the jointly-owned University of Illinois--Illinois Central Railroad dynamometer car, handling it for both instructional and experimental purposes.

Max Albert Faucett, (B.S., 1921, and M.S., 1924, Rose Polytechnic Institute; E.E., 1929, University of Illinois), became Instructor in Electrical Engineering at the University of Illinois in 1923, Associate in 1931, Assistant Professor in 1937, and Associate Professor in 1944. He is co-author of a textbook entitled "Machines in Electrical Engineering", of another "Circuits in Electrical Engineering", and of still another "Circuits and Machines in Electrical Engineering". He is also co-author of one bulletin of the Engineering Experiment Station.

Luther Bunyan Archer, (B.S., 1922, University of Texas; M.S., 1924, and E.E., 1930, University of Illinois), joined the College staff here in 1924 as Assistant in Electrical Engineering and became Instructor in 1926, Associate in 1930, and Assistant Professor in 1938, and Associate Professor in 1945.

Carl Eric Skroder, (B.S., 1921, Worcester Polytechnic Institute; M.S., 1929, University of Illinois), was employed in engineering practice until he came to the

University here in October, 1925, as Instructor in Electrical Engineering. He was made Associate in 1931, Assistant Professor in 1938, and Associate Professor in 1945. Professor Skroder is author of a textbook entitled "Laboratory Analysis of Direct-Current Machines."

Harold Nathaniel Hayward, (B.S., 1925, M.S., 1930, and E.E., 1941, University of Illinois), was engaged in practice until he became Instructor in Electrical Engineering here in September, 1929. He was made Associate in 1934, Assistant Professor in 1941, and Associate Professor in 1945. He was on leave of absence from November 15, 1944, until August 31, 1945, to serve in the Bureau of Ships of the U.S. Navy.

Gilbert Howard Fett, (B.S., 1931, and Ph.D., 1940, University of Illinois; M.S., 1932, Iowa State College), after graduate work at Iowa State College was employed in engineering practice until he joined the College staff here in 1935 as Assistant in Electrical Engineering. He was made Instructor in 1937, Associate in 1941, Assistant Professor in 1943, and Associate Professor in 1945. He is joint author of a text entitled "Introduction to Circuit Analysis".

Edward Conrad Jordan, (B.S., 1934, and M.S., 1936, University of Alberta; Ph.D., 1940, Ohio State University) served as teacher at Worcester Polytechnic Institute and at Ohio State and was for a time engaged in research at Ohio State with the Research Foundation before he came to the University of Illinois in October, 1945, as Associate Professor of Electrical Engineering. He is co-author with W. L. Everitt of a textbook entitled "Fundamentals of Radio".

d. Assistant Professors

Bernard Victor Swenson, (B.S. in E.E. and B.S. in M.E., 1893, and M.E., 1901, University of Illinois; E.E., 1901, University of Wisconsin), served as Instructor in Electrical Engineering in the Department of Physics at the University here during 1893-95, and as Assistant Professor in the Department of Electrical Engineering during 1895-98. He left to accept an appointment at the University of Wisconsin.

William Hand Browne, Jr., (A.B., 1890, Johns Hopkins University), was employed for a number of years after graduation in engineering practice, then served as Instructor

in Electrical Engineering at the University of Nebraska from 1896 to 1898, after which he came to the University of Illinois as Assistant Professor of Electrical Engineering. He remained here until 1902, when he resigned and later became Professor of Physics and Electrical Engineering at North Carolina State College of Agriculture and Mechanic Arts. Still later, he became Professor of Electrical Engineering and Head of the Department at that institution, where he has remained to the present time (1945).

William Henry Williams, (B.E.E., 1896, University of Wisconsin), was engaged in teaching work after graduation and came to the University of Illinois in 1902 as Assistant Professor of Electrical Engineering. He remained here three years and left to enter commercial work.

Thomas Mooney Gardner, (B.M.E., 1892, Purdue University; M.M.E., 1896, Cornell University), was employed in practical work and in teaching positions from 1892 to 1905, after which he became Assistant Professor of Electrical Engineering here. He withdrew at the end of the school year, however, to accept a position at Oregon State College.

Harry Peterman Wood, (B.S., 1899, and E.E., 1903, Pennsylvania State College), served as Assistant Professor of Electrical Engineering at the University of Illinois during the year 1906-07, after having been engaged in engineering practice for a time, and as Assistant Professor at his alma mater during 1902-06. He withdrew to accept an apointment as Professor of Electrical Engineering at Georgia Institute of Technology.

James Myron Bryant, (B.S., 1901, and E.E., 1909, Worcester Polytechnic Institute; M.S., 1911, University of Illinois), became Instructor in Electrical Engineering here at the University in 1903, Associate in 1907, and Assistant Professor in 1909. He resigned in September, 1914, to take a position as Head of the Department of Electrical Engineering at the University of Texas, where he remained until 1928. During 1925-29, he gave attention to consulting practice, after which he joined the staff at the University of Minnesota as Professor of Electrical Engineering and Head of the Department, and has continued there to date. Professor Bryant is joint author of one bulletin of the Engineering Experiment Station at the

Philip Sheridan Biegler, (B.S., 1905, and E.E., 1915, University of Wisconsin; M.S. 1916, University of Illinois), was in turn, Instructor and Assistant Professor of Electrical Engineering at the University of Iowa during 1906-09. He was engaged in engineering practice during 1909-10, and was Assistant Professor of Electrical Engineering at Purdue University in 1910-11, and Professor of Electrical Engineering at the University of Montana during 1911-13. He joined the staff at the University of Illinois in 1913 as Assistant Professor of Electrical Engineering, and remained here until September, 1918, when he withdrew to become Associate Editor of the Electrical World. After three years in that position, he went to the State College of Washington as Associate Professor of Electrical Engineering. In 1923 he became Professor of Electrical Engineering and Head of the Department at the University of Southern California, where he has remained to date. In addition, during 1928-1940, he served as Dean of the College of Engineering there.

Trygve D. Yensen. (B.S., 1907, M.S., 1912, and E.E., 1913; and Ph. D. in Physics, 1927, California Institute of Technology), spent a year with the General Electric Company, then a year (1908-09) as Assistant in the Department of Electrical Engineering at Illinois. Following another year in practice, Mr. Yensen came to the University as an Assistant in the Engineering Experiment Station. After five years he became First Assistant in the Station and in January, 1916, became Research Assistant Professor in Electrical Engineering. He resigned in July, 1916, to accept a position with the Westinghouse Electric and Manufacturing Company in their Research Laboratory. At present, he is Manager of the Magnetic Department of that company. He was awarded the Edison medal by the American Institute of Electrical Engineers in 1908, and the Howe Medal by the American Society for Metals in 1935. He is author of four bulletins and co-author of one more, published by the Engineering Experiment Station. He has developed many patents and has contributed many papers to the technical press.

Ira William Fisk, (B.S., 1909, and M.S., 1913, University of Illinois), served as Assistant in Electrical Engineering here during 1910-11, Instructor during 1911-13, as Associate during 1913-17, and as Assistant professor during 1917-18. He resigned

in September, 1918, to become Head of the Department of Electrical and Mechanical Engineering at Drexel Institute. Later he joined a firm of consulting engineers in New York City.

Albert James Ebel, (A.B., 1937, University of Iowa; M.S., 1943, University of Illinois), who became Chief Engineer of the radio station W-I-L-L in 1937, joined the staff in September, 1944, as Assistant Professor to assist for a time in the instructional work of the Extension Division and later in the regular work of the Department. He resigned in February, 1946, to enter commercial radio practice.

Harry Wallace Horn, (A.B., 1930, University of Kansas; B.S., 1935, University of Illinois; and M.S., 1937, Massachusetts Institute of Technology), was made Instructor in Electrical Engineering here in September, 1937, Associate in 1944, and Assistant Professor in 1945. He was on leave of absence for war service from July 1, 1944, until July 1, 1946.

Marion Stanley Helm, (B.S., 1933, and M.S., 1934, University of Illinois), became Instructor in Electrical Engineering at the University in September, 1938, after spending four years in engineering practice. He was promoted to the rank of Associate in 1944, and Assistant Professor in 1945.

George Roland Peirce, (B.S., 1936, and M.S., 1937, University of Illinois), was employed in engineering practice after graduation until he joined the College staff here in September, 1938, as Instructor in Electrical Engineering. He has made Assistant Professor in 1945.

c. ASSOCIATES

Thomas Hamer Amrine, (B.S., 1906, and E.E., 1908, University of Illinois), served as Assistant in Electrical Engineering in the Engineering Experiment Station during 1906-07, as First Assistant during 1907-09, and Associate during 1909-10, during which time he was author of two bulletins and co-author of one more, published by the Engineering Experiment Station. He resigned from the University to enter engineering practice with the General Electric Company, his last position with the organization being Manager for Japan, where he and his family perished in the Tokio Earthquake on September 1, 1923.

Leonard Vaughan James, (B.S., 1906, and M.S., 1912, University of Illinois), spent a year in industry, then came to the University in September, 1907, as Assistant in Electrical Engineering. He was made Instructor in 1909, and Associate in 1913. He withdrew in September, 1918, to become Head of the Engineers Division, School of Military Aeronautics, at Austin, Texas.

Charles Ruby Moore, (B.S. in E.E. and B.S. in M.E., 1907, and E.E., 1910, Purdue University), served as Instructor in Electrical Engineering at Purdue during 1907-10, and as Assistant Professor there during 1910-13. He was engaged in engineering practice during 1913-14, after which he served as Instructor in Electrical Engineering at the University of Illinois from February to September, 1915. He was made Associate in 1915, but withdrew in June, 1916, to engage in engineering practice again.

Freeman Thayer Tingley, (B.S., 1922, Bucknell University; M.S., 1929, University of Illinois), served as Associate in Electrical Engineering for the year 1929-30 to take the place of Charles Alvin Keener, who was on leave of absence. He left at the end of the academic year to become Assistant Professor of Electrical Engineering at Clemson College.

Laurence Lewis Smith, (B.S., 1927, University of Nebraska; M.S., 1937, and LL.B., 1939, University of Illinois), was employed in practical work until he joined the College staff here in 1929 as Instructor in Electrical Engineering. He was made Associate in 1934, and continued with the Department until the summer of 1941,

when he withdrew to take an appointment with the General Electric Company. He is author of one bulletin of the Engineering Experiment Station.

William Joseph Warren, (B.S., 1931, University of Santa Clara; M.S., 1933, and Ph.D., 1936, University of Illinois), became Assistant in Electrical Engineering at the University of Illinois in September, 1934, and Instructor in 1935. He withdrew from the University in 1936 to accept a position in engineering practice, but returned to the Department in September, 1938, as Associate in Electrical Engineering. He withdrew from this position during the summer of 1941 to take charge of the work in electrical engineering at the University of Santa Clara.

f. Instructors and Research Assistants

Frank Gardner Willson, (B.S., 1903, University of Wisconsin; M.S., 1913, University of Illinois), served as Instructor in Electrical Engineering at the University here from 1905 to 1913, when he resigned to become Head of the Department of Applied Electricity at Wentworth Institute.

Edgar Issac Wenger, See Railway Engineering, Chater XX.

Harry Gray Hake, (B.S., 1907, M.S., 1910, and E.E., 1913, University of Illinois), immediately after graduation became Assistant in Electrical Engineering here, then Instructor, and remained with the Department until July, 1913, when he withdrew to accept a position at Washington University, St. Louis. He is joint author of one bulletin published by the Engineering Experiment Station.

Frank Carlton Loring, (B.S., 1904, Purdue University; M.A., 1907, Columbia University), was engaged in teaching work and practice for a time after graduation, then in 1912 joined the staff at the University of Illinois as Instructor in Electrical Engineering.

He remained here only until November, 1913, when he withdrew to become connected with Government service at Washington, D.C.

John William Davis, (M.E., 1910, Cornell University; M.S., 1917, University of Illinois), served as Assistant in Electrical Engineering at Harvard University during 1910-11, as Instructor in Mathematics and Physics at Vanderbilt University during 1912-13, and as Instructor in Electrical Engineering at Leland Stanford University during 1913-14. He came to the University of Illinois in 1914 as Instructor in Electrical Engineering and remained here until September, 1917, when he withdrew to go into military service.

Walter Arthur Gatward, (B.S., 1913, Washington State College; M.S., 1916, University of Illinois), was made Research Assistant in Electrical Engineering here in September, 1916, but withdrew in March, 1918, to enter engineering practice. He is joint author of one bulletin of the Engineering Experiment Station.

Peter Jacob Nilsen, (B.S., 1915, University of Illinois), spent a year in practice with the Illinois Public Service Commission, then in September, 1916, became Instructor in Electrical Engineering here. He resigned, however, in May, 1917, to take a position in practice again.

Paul Henry Burkhart, (B.S., 1916, University of Illinois), spent two years as Assistant at the Massachusetts Institute of Technology, then joined the College staff here in September, 1918, as Instructor in Electrical Engineering. He remained until June, 1922, when he accepted an appointment in the Department of Electrical Engineering at Yale University.

George Sims Parker, (E.E., 1914, Syracuse University), became Instructor in Electrical Engineering at the University of Illinois in September, 1920, but left in June, 1922, to be Assistant Professor of Electrical Engineering at Syracuse University.

Cornelius Shiland Bullions, (E.E., 1916, Rensselear Polytechnic Institute), was engaged in practice for several years after graduation before he joined the College staff here in September, 1921, as Instructorin Electrical Engineering. He remained here until September, 1925, when he accepted a position as electrical engineer

with the Penn Public Service Company at Johnstown, Pennsylvania.

Albert Lyle Chavannes, (B.S., 1918, University of Tennessee), spent several years as a teacher at the University of Tennessee, then came to the University here as Instructor in Electrical Engineering in September, 1922. He withdrew in June, 1923, to accept an appointment with the Southern California Edison Company at Los Angeles.

Frank Charles Mock, (E.E., 1913, Columbia University; A.M. in Physics, 1916, University of Michigan), became Instructor in Electrical Engineering here in February, 1924. He remained here until June, 1926.

Harold Funstron Huffman, (B.S., 1924, University of Kansas), followed eingineering practice until he came to the University of Illinois in 1926 as Instructor in Electrical Engineering. He remained here until 1929, when he accepted an appointment at Southern Methodist University.

Arthur Willis Hershy, (B.E.E., 1925, Ohio State University; M.S., 1929, University University of Illinois), became Instructor in Electrical Engineering here in September, 1926, and continued in that position until September, 1929, when he took a position with Leeds & Northrup Company.

Maurice Coffyn Holmes, (B.S., 1925, University of West Virginia; M.S., 1927, Massachusetts Institute of Technology), served as Special Research Assistant here from September, 1928, to July, 1929.

Lloyd Parker Morris, (B.S., 1928, University of Illinois), served as Special Research Assistant in Electrical Engineering from September, 1929, to March, 1932.

Robert Stanley Jordan, (B.S., 1930, and M.S., 1931, University of Illinois), was Instructor in Electrical Engineering from October, 1931, to February, 1932.

Charles E. Krause, (B.E., 1921, and E.E., 1927, University of Iowa), served as Instructor (half time) in Electrical Engineering here during 1934-35.

James Curtis Mace, Jr., (Ph.B., 1929, Ripon College; M.S.,1934, and Ph.D., 1940, University of Illinois), became Instructor in Electrical Engineering here in September, 1938. He was given a leave of absence on November 7, 1942, to go into war work.

James Henry Smith, (E.E. and M.S., 1931, University of Cincinnati), spent several years in engineering practice and later served as Head of the Department of Electrical Engineering at Detroit Institute of Technology. He became Instructor in Electrical Engineering at the University of Illinois in September, 1939, and remained here until the summer of 1941, when he withdrew to enter engineering practice again.

Louis Richard Bloom, (B.S., 1938, and M.S., 1939 and 1941, University of Illinois) became Research Assistant in Electrical Engineering in September, 1940, and remained with the University until December, 1943. He is joint author of one bulletin and one circular issued by the Engineering Experiment Station.

Albert David Bailey, (A.B., 1936, Iowa State Teachers College; B.S., 1938, Iowa State College), became Instructor in Electrical Engineering at the University of Illinois in September, 1941, and has retained that position to date, although he was given a leave of absence on July 1, 1944, to join the U.S. Navy.

Wendell Earl Miller, (B.S., 1936, University of Illinois) joined the staff at the University of Illinois in September, 1941, as Instructor in Electrical Engineering. He was granted a leave of absence on December 1, 1943, to enlist in the U.S. Navy.

Paul Fowler Schwarzlose, (B.S., 1928, University of Illinois), came to the University in September, 1941, as Instructor in Electrical Engineering, and has remained with the staff to date (1945).

G. SUMMARY

General - Electrical Engineering was at first a division of Physics and was also closely associated with Mechanical Engineering. The rapid development of electricity in its application to arc and incadescent lighting and to small power-plant operation, however, offered an opportunity for the organization of a separate department to train men in these particular fields. Then later, the

growth of facilities in telephony, illumination, central-station power production and distribution, transportation, radio and electronics further extended the possibilities for training along these particular lines and brought about such an enrollment of students as to make the Department one of the major units in the College.

The Department has always attempted to maintain its laboratory facilities something like parallel to developments in industry, although it has met with some difficulty in this direction because of the rapid succession of changes that have come about in practice. In spite of changing conditions, though, its instructional program has been systematically sound and has not materially deviated from its original objectives of turning out a body of graduates that would be able to enter any phase of the industry and serve with distinction in their chosen profession.

As opportunity has presented itself, the members of the staff have devoted as much time as they could spare from their instructional work to carry on research projects in their particular line of specialization. In large measure, they have been successful in these attempts and have been able to produce some major contributions towards the development of this rapidly-expanding industry.

CHAPTER XV

THE DEPARTMENT OF RAILWAY ENGINEERING

A. ORGANIZATIONS FOR RAILWAY INSTRUCTION[1]

Railway Engineering.- In 1898, the Department of Mechanical Engineering began to offer a curiculum arranged for students preparing to enter the motive-power department of railway service. The curriculum continued to attract some interest among students; and with this as a nucleus, the Board of Trustees, on January 30, 1906, authorized the organization of the Department of Railway Engineering with

1 The following letter from President James addressed to Dean J.M. White under date of January 3, 1906, has general interest in this connection:

"I have for some years felt that somewhere in the United States should be organized a school for the training of railway employes and managers in all different departments of railway service.

"Since being here I have wondered whether we had not the foundation already laid for the erection of such a school,- a school perhaps to be called a School of Railway Engineering and Management or some similar title.

"We might simply group together for this purpose the various courses in engineering which are offered in the Engineering College and the courses of transportation considerably enlarged which are given in the College of Literature and Arts, so as to offer a center for the study of railway problems of all sorts,- engineering, organization, rate making, financiering, administration.

"If the time has come when the creation of such a school is feasible and if we can undertake it here, I believe it will be of marked advantage to the University.

"Such a school might be organized without interfering with the administrative organization of the University at all, somewhat along the lines of the School of Education which has been recently organized. It would be necessary probably to add to our force of instructors a director of the school,- a man known for his ability in some line of railroad work.

"This of course would be a matter of detail.

"I would be glad if you would lay this suggestion before the College of Engineering and if it seems to the faculty that there is anything of value in it to appoint a committee to consider it and make a report upon it."

Faithfully yours,

(Signed) Edmund J. James.

The Committee appointed consisted of Professor Baker, Talbot, and Breckenridge, who after careful consideration, recommended that steps be taken immediately in the direction of President James' suggestion, but that instead of a separate School, only a Department of Railway Engineering within the College of Engineering be established at that time with three divisions,- one in railway civil engineering, one in railway mechanical and electrical engineering, and one in railway administration, the latter dealing with courses common to the railway curricula and possibly some special railway topics and with a number of courses

power to offer three curricula,- railway civil engineering, railway electrical engineering, and railway mechanical Engineering,- for it was thought that by offering additional specialized training and broadening the field of instruction, the University could render a valuable service to the railway interests of the State and Nation, which at that time were at the peak of their construction program. The curricula in railway civil and railway mechanical engineering were intended primarily for those who expected to enter the services of steam roads in the departments of construction and maintenance of way and of motive power. The curriculum in railway electrical engineering was arranged for those who would find employment on electric railways or in the service of steam roads with electrified lines.

Railway Engineering and Administration.- For a number of years prior to the organization of the Department of Railway Engineering, courses in railway administration had been offered in the Department of Economics in the College of Literature and Arts, in which special attention was being given to corporate and financial organization, economic location, traffic management, rate making, railway accounting, etc. At the suggestion of President James, who saw an opportunity for a comprehensive plan of education for railway service by coordinating the work offered in railway engineering and railway administration, there was organized the School of Railway Engineering and Administration,- an action approved by the Board of Trustees on January 22, 1907. As stated in the 1907-08 issue of the Register, the purposes of this School were:

" To meet the demand for technically-trained men for railway service-not only for the engineering departments, but for the financial, traffic and operating departments as well,-- there has been established a School of Railway Engineering and Administration.

---

from the Department of Economics. As the plan was finally worked out, however there was established at that time three separate curricula in railway engineering,-one in railway civil engineering, one in railway electrical engineering, and one in railway mechanical engineering,- and next year there was provided the School of Railway Engineering and Administration according to President James' idea with the Dean of the College of Engineering as director.

"It is the function of this school to coordinate the various facilities of the University so as to provide specialized training for all branches of railway service. In developing the plan, there has been created in the College of Engineering, a separate department of railway engineering; and the department of economics of the College of Literature and Arts has added to its business courses, one in railway administration."

"It is the purpose of this school to provide courses of training which shall prepare men to become efficient workers on steam and electric railways in all departments except the legal."

A circular issued in 1913 describing the Transportation Building, the Locomotive Laboratory, and the Mining Laboratory, contained the following statement concerning the School of Railway Engineering and Administration:

"Illinois is second among the states of the Union in its mileage of railway tracks, and twenty-two per cent of the people in the state depend for their support upon trade and the transportation interests. In view of these facts, the Trustees have deemed it important that the activities of the University embrace such lines of instruction and research as will best prepare men for positions of responsibility in the railway service."

The activities of the School of Railway Engineering and Administration were suspended in 1917 when some of the leading members of its faculty were called away for service in World War I, and the School was never re-established.

B. OFFICE, CLASSROOM, AND DRAWING-ROOM ACCOMMODATIONS

General.- From the time of its organization in 1906 until the completion of the Transportation Building in 1912, the Department of Railway Engineering had its offices, classrooms, and drawing rooms in Engineering Hall. As soon as the Transportation Building was ready for occupancy, the Department took over the entire first floor of that building. The department office was in Room 101, where it remained until the Department was dissolved in 1940. Room 117 was used as a students' study room and Room 202 on the second floor was taken over for a joint library for Railway and Mining Engineering. Because at times there

was no attendant and because of other difficulties, the library was abandoned in 1918, when most of the books were deposited in the newly-formed Engineering Library.

C. FOREIGN STUDENT ENROLLMENT

Foreign Students in Railway Work.- Because of their inherent interest in railway lines, many foreign students were enrolled in railway classes. There were both undergraduates and graduates in this group, the largest single representation being Chinese, practically all of whom came with scholarships endowed or subsidized by their national or local governments. Because these scholarships were competitive, most of these students came with high scholastic records, and continued to maintain such records during their connections with the University. Their lack of practical experience in their chosen fields operated somewhat as a handicap to many of them, however, but it seemed to spur them on to greater effort in their attempts to make the best of their opportunities while studying and traveling in this country. There is no way to estimate even the value of the training which these men received, but there is ample reason to believe that the experience they gained here has been turned to profit in many ways, in the improved operation of the common carriers of their respective lands, and in advancing to higher levels the professional standards of their several scientific and administrative personnel.

D. RELATIONS WITH LOCAL RAILWAYS

General.- The following statement, taken from the 1907-08 issue of the University Register, indicates the fortunate position in which the University found itself in its relations with the local railways;

"Three steam roads - the Illinois Central, the Cleveland, Cincinatti, Chicago, and St. Louis, and the Wabash Railroads- and an electrical interurban road- the Illinois Traction System- enter Champaign and Urbana. The department enjoys the interest and cooperation of the officers of these railways and is afforded by their courtesy, numerous opportunities for practical road tests and field work. The division shops of the Cleveland, Cincinnati, Chicago, and St. Louis Railroad are located in Urbana, and provide additional opportunity for similar work."

E. DEVELOPMENT OF LABORATORY FACILITIES IN RAILWAY ENGINEERING

General.- The laboratory equipment maintained by the Department of Railway Engineering in 1940, when the Department was discontinued, included a locomotive testing plant, a brake-shoe testing plant, an electric railway laboratory, a dynamometer car or steam railway test car, an electric railway test car, a drop-test machine, an assembly of air-brake equipment, and a group of railway signal mechanisms. Many of these facilities, described at some length in the following paragraphs, are still in use in 1945, but they have been transferred to other departments.

Locomotive Testing Plant.- Because of the many inherent difficulties involved in the conduct of locomotive road tests due to uncertainties arising from operating conditions and to variations in the conditions of traffic, wind and weather, and track and roadway, the locomotive laboratory has been developed as an agency for obviating these problems. The fact, too, that in the laboratory the locomotive operates as a fixed machine, thereby permitting the use of delicate accessory apparatus in testing as in any other stationary power plant, and admitting of a degree of accuracy not possible in the conduct of road tests, is a major argument favoring the testing plant.

The mounting mechanism for receiving the locomotive to be tested, with which the laboratory at the University of Illinois was equipped in 1912, was of original design and of such capacity as to give accommodation to the largest locomotive built including the Mallet and articulated types. Supporting wheels[1] were designed to carry the locomotive drivers,-one wheel for each driver on the locomotive. The power transmitted to such supporting wheels through friction between the two sets of wheels, was absorbed by a hydraulic brake which consisted of three cast-iron disks keyed to a supporting axle, each disk revolving between two copper plates attached to the surrounding stationary casing and forming a closed compartment

1. It is interesting to note that the Midvale Steel Company of Philadelphia donated to the University the four pairs of supporting wheels and axles. The materials were made of heat-treated steel of unusually high grade and represented the finest product of this sort obtainable. The monetary value of the gift was $2,700:- The Technograph, December, 1912, Page 29.

The surfaces of the cast-iron disks and copper diaphragms that were in mutual contact, were lubricated by a continuous flow of oil under pressure; and opposite surfaces of the copper diaphragms were cooled by circulating water. The pressure of the cooling water could be varied by means of suitable valves in accordance with the amount of power to be absorbed. The entire power of the locomotive was thus dissapated at the surface of the copper diaphragms, and was carried away as heat in the water that circulated through the hydraulic brakes.[1]

The locomotive was anchored by its draw-bar to a dynamometer, which consisted essentially of a weighing head and a weighing scale, designed and built by the William Sellers Company of Philadelphia. Within the weighing head was an oil chamber with a flexible wall, which received and balanced any force transmitted through copper tubes of small bore to a smaller oil chamber, the pressure within which moved the beam of a substantial but very sensitive scale. The force transmitted to the dynammoeter was thus weighed. The capacity of this dynamometer was such as to permit the measurement of a force as great as 125,000 pounds, and yet so delicate as to permit great accuracy when the forces to be measured were small. Two special features of this part of the plant were that the adjustment of the poise weight on the scale beam was accomplished automatically, and that the amount of the force weighed on the scale was recorded autographically.

The laboratory was equipped with an elevator for use in carrying fuel from the storage bin to the firing platform, with scales upon which to weigh the coal as fired, and with a series of weighing tanks by the use of which the amount of water delivered to the boiler could be accurately determined. There were steam-engine indicators for measuring the power developed in the cylinders and a supply of thermometers, pyrometers, and calorimeters for use in studying the behavior of the various parts of the whole machine.

A new method was employed in this laboratory for disposing of the exhaust gases and in determining the amount of fuel lost in the exhaust, the latter being an item of considerable importance. Heretofore to determine the fuel lost

1. These brakes were designed and furnished by Professor G.I. Alden of Worcester Polytechnic Institute.

in the exhaust gases, it had been customary to collect in a sampling tube the solid matter which passed a small section of the exhaust-gas stream, and prorate the loss thus determined over the entire stream section. This method was always inconvenient, and under certain conditions, its results were open to doubt. In the plant at the University of Illinois, the exhaust gases as they emerged from the locomotive stack were discharged into a steel exhaust elbow which carried them up and over to a horizontal duct running through the roof trusses. The gases were drawn through this elbow by an exhaust fan. The gases and solid matter were delivered into the spark trap or cinder collector, which consisted of a stack 41 feet high rising from the top of a larger cylinder, 36 feet high. The cylindrical lining of the stack projected down about 12 feet into the supporting cylinder. The exhaust gases were delivered horizontally against the side of this cylindrical lining, considerably above its lower end, and consequently they could escape up the flue only by flowing around the lining and downward into its lower end. The whirling action of the gases caused the cinders to be thrown against the walls of the cylinder which supported the stack, from whence they dropped into a hopper below. Thus, all of the cinders were collected and weighed--an innovation which permitted a more accurate determination of the fuel lost through the exhaust.[1]

In line with attempts at conservation of resources, a concrete reservoir having a capacity of 90,000 gallons was built outside the laboratory near Goodwin Avenue in the fall of 1913 for the purpose of collecting and cooling the water used for operating the brakes.

A new set of supporting wheels similar to the others was later presented to the department by the Standard Steel Works, a subsidiary of the Baldwin Locomotive Works. This permitted the testing facilities to accommodate an engine with five drivers instead of four. This entire plant was designed, installed, and operated under the general direction of Professor E.C. Schmidt, Head of the Department.

1. The first locomotive installed for testing on the new plant was Illinois Central Consolidation type, No. 958. It came directly from the Burnside Shops of the Illinois Central in Chicago, moving over the Illinois Central and Chicago and Eastern Illinois lines to Glover and thence over the Illinois Traction System to the campus. It was placed on the plant on April 12, 1913.

When the Department of Railway Engineering was discontinued in 1940, the laboratory was assigned to the Department of Mechanical Engineering. Later, however, it was decided to discontinue the plant; and the work of dismantelling it was begun during the latter part of 1943, so that the building could be arranged for other uses. Most of the dismantelling was done by the end of that year, and the stack was taken down during the following spring. Some of the equipment was taken for use by other departments here in the College, but most of it, together with the parts that had been received from the Iowa State College plant, was shipped away for conversion into war materials. In the fall of 1944, the building was assigned temporarily to the newly-created Department of Aeronautical Engineering for laboratory purposes.

Aside from its value for instructional purposes in connection with the curricular program in railway engineering, this plant, one of only two or three of its kind in America, served as a means for conductiong many experiments carried on in cooperation with the common carriers and commercial interests of the State. Several important bulletins presenting information that was useful alike to those engaged in locomotive construction and locomotive operation, were published by the Engineering Experiment Station from data developed during the operation of this plant. There is no way to calculate the value of this instructional and experimental effort, but there is little doubt that its contributions towards a better knowledge of locomotive performance far outweigh any sums of money invested in the construction and operation of this peculiar and unusual assemblage of laboratory apparatus.

Locomotive 431.- In December, 1915, after the locomotive testing plant was completed, the Illinois Central Railroad Company loaned the University their locomotive No. 431,[1] a Mogul, or 4-6-0 type, using saturated steam, for instructional use in connection with laboratory exercises. This machine, thus saw considerable service and served a very useful purpose in providing data for classroom and laboratory work. In addition, this locomotive in operation on the testing plant, was always one of the main exhibits of the Engineering Open House or other special occasions bringing visitors to the campus. The locomotive remained in the laboratory until

1 The drivers were 56 inches in diameter, the cylinders were 19 by 26 inches, and the steam pressure was 160 pounds a square inch. The engine and tender together weighed 206,000 pounds, when the locomotive was in service with the Railroad. The tender itself was not delivered here.

November, 1942, when it was returned to the Illinois Central for use in branch-line operation.

Brake-Shoe Testing Machine.- The brake-shoe testing machine, designed by members of the Department of Railway Engineering in accordance with the specifications of the Master Car Builders' Association, was built in 1908-09 at the Burnside shops of the Illinois Central Railroad Company and was installed in June, 1910, towards the west end of what was then the morth bay of the Mechanical Engineering Laboratory. The plant was provided with apparatus not only to study the performance of brake shoes themselves, but also to determine the stresses, temperatures, and structural phenomena developed in the rotating wheel. The equipment consisted essentially of a shaft carrying a flywheel and a standard cast-iron or steel wheel. The shaft could be driven at any desired speed by means of an independent engine which transmitted motion to the main shaft through a belt, pulley, and clutch. The design of the flywheel was such as to make available at the surface of the car wheel the same amount of energy as would be impressed upon one wheel of a 60,000-pound capacity car in service, under like conditions of speed.

The brake shoe to be tested was suspended above the car wheel from a lever by means of which the shoe could be applied to the wheel with any desired presure up to 18,000 pounds. The tangential pull of the shoe thus applied to the moving wheel was transmitted to a Sellers' dynamometer where it was recorded upon a moving paper chart. By this means the coefficient of friction of any shoe could be determined under any desired condition of shoe pressure and speed up to 85 miles an hour. The machine served, also, in the determination of shoe and wheel wear under conditions similar to those in service.

In the fall of 1916, at the time when the Mechanical Engineering Laboratory was being remodelled, the brake-shoe equipment and the Chandler and Taylor engine, which was built in 1908 and which had been in service to power the plant since it was installed in 1910, were transferred to a 29 by 35-feet, one-story, stucco building erected at that time on the site of the proposed railway electrical laboratory, discussed in the following section. Some improvements were made to the equipment from time to time in later years, to correspond to changed conditions in practice, one

of which was to permit an increase in speed to 140 miles an hour, and another, an increase in bearing pressure to 22,000 pounds.

When the Department of Railway Engineering was abolished in 1940, the plant was assigned to the Department of Theoretical and Applied Mechanics, under the immediate supervision of Professor H.J. Schrader. After the engine became damaged beyond repair by an accident in 1941, the old Ball engine formerly used in the Mathews Avenue Power Plant, was put in as a substitute. About that time, also, a substantial steel enclosure was constructed for the wheel under test in order to afford protection for the attendants at work in the room.

This plant, one of the few of its kind in the United States, has served for a number of years as a means for conducting experimental projects in cooperation with the leading car-wheel and brake-shoe manufacturers in America. It has been in service almost continuously since it was installed and has been the instrumentality for providing a comprehensive body of knowledge that has materially influenced the design of steel and cast-iron car wheels and of various types of brake shoes and brake-shoe linings in the effort to provide safer and more efficient operation in American train service.

Electric Railway Laboratory.- The plan for railway development at the University called for a laboratory patterned on the plan of the locomotive laboratory that would be built immediately west of the locomotive building for housing a plant devoted to railway electrical engineering and other phas s of railway service. In conformity with this idea, a small temporary structure was erected on the intended site in which was installed on more or less permanent foundations, the brake-shoe equipment, described in the previous paragraph. This building, known as the brake-shoe laboratory, like the locomotive laboratory, was placed at an angle with the street and property line in order to permit a better track alignment from the Illinois Traction System, if and when the railway electrical laboratory could itself be constructed.

When it became evident that a complete laboratory for railway electrical engineering could not be realized, a short extension was built on the west end of the brake-shoe laboratory in 1923 to house the first unit of railway electrical equipment. This equipment and later installations are described in the following paragraphs.

As a source of power supply for the electric-railway equipment, there was provided an underground cable from the switchboard in the Mathews Avenue Power Plant to a bank of outdoor transformers located immediately north of the Laboratory building. These transformers reduce the power pressure from 2,300 to 230 volts for operating a 40-kilowatt motor-generator set which supplies 600 volts direct current, the kind of current used by a mojority of the street railway systems of this country.

A switchboard was provided, by means of which the 600-volt current is connected to the railway motor test set. This set consists of an automatic motor controller like those used on the motor cars of the Illinois Central Terminal Electrification in Chicago, that serves to regulate the current supplied to the motors, which are two 25-horsepower units of the same type as those usually found on the one-man safety cars that operate on nearly all street-railway systems in the United States.

The motors are geared to a shaft on which two solid iron flywheels are mounted. The wheels have the same weight and inertia as a standard Barney safety car,-namely 16,000 pounds,- so that the motors in bringing the wheels up to speed, do the same amount of work as that done by the motors under a safety car during the period of acceleration. Specially-constructed prony brakes are used to load the motors after the desired speed is reached.

There was installed also in the laboratory a 14-horsepower single-phase series motor having characteristics similar to the driving motors which opperate cars on the New York, New Haven, and Hartford Railroad electrification out of New York City. This motor can operate either on direct current or on 25-cycle alternating current. The motor-generator set previously mentioned furnishes the current at proper voltage for operating the motor.[1]

A general Electric mercury-arc rectifier was received in 1926-27 and installed in the laboratory as an alternate means for supplying current, for previous to that time, alternating current could be converted into direct current only by means of the motor-generating set. The new outfit has a factory rating of 40 kilowatts at 600 volts direct current. The rectifier has two tubes, each of glass from which all air has been extracted and which have been filled with mercury. The tubes are of the three-phase type and contain three anodes,-two exciting anodes and a mercury starting

1 The Technograph, November, 1926, Page 28

anode,- and a cathode.

When the Department of Railway Engineering was discontinued in 1940, the laboratory was transferred to the Department of Electrical Engineering and has continued to be operated by Professor J.K. Tuthill for instructional purposes in connection with classroom work in railway electrical engineering.

Dynamometer Car or Railway Test car No. 17, 22, and 30.- The railway test car, originally known as No. 17 until 1915, when the Illinois Central Railroad changed the numbering on some of its rolling equipment, and after, that as No.22 until the latter part of 1926, since when it has been known as No. 30, is owned and operated jointly by the University and the Illinois Central Railroad Company. Having been designed for instructional and experimental purposes in the study of train resistance and locomotive performance on steam railway lines, it has formed an important part of the equipment of the College of Engineering. As previously mentioned, this car was built originally in 1900 under the direction of members of the staff of the Department of Mechanical Engineering and was transferred to the Department of Railway Engineering when that Department was organized in 1906. The car was modernized from time to time,- some portions of the apparatus being entirely rebuilt a few years ago,- and was thoroughly equipped with the best available facilities for making train-resistance and tonnage-rating tests including locomotive road tests.

The dynamometer itself is of the hydraulic transmission type. The special instruments included in the car equipment consist of devices for measuring the force exerted on the train by the locomotive, the speed of the train, the velocity and direction of the wind, and the temperature of the car journals or bearings. All of these measurements are automatically recorded by pens upon a strip of heavy paper which moves slowly over the recording table at a rate proportionate to the speed of the car. The record includes, also, the location of the mile-posts, stations, and other land-marks along the right of way.

Several important tests have been made by means of the car on the Central Railroad of New Jersey, the Baltimore and Ohio, the Big Four, and the New York Central. The most significant tests, though, have been made on the Illinois Central where it has been extensively used by members of the Department not only for providing valuable

information to that company regarding certain phases of train operation, but also for furnishing instruction to students enrolled in railway courses in University and for supplying data which formed the basis for the publication of several important bulletins of the Engineering Experiment Station.here,- materials that have been very influential in establishing standards for train-resistance tables and locomotive performance in American railroad practice.

When the Department of Railway Engineering was dissolved in 1940, the car was assigned to the Department of Electrical Engineering under the immediate direction of Professor J.K. Tuthill, who had been directly responsible for its operations for a number of years prior to that time. In the summer of 1943, the car was supplied with an entirely new steel body and underframe, making it probably the most outstanding of its kind in existence.

Electric Railway Test Car.- A test car of the interurban type, especially designed and built in 1905 for the University for experimental and instructional purposes on electric railways, was received from the Department of Electrical Engineering when the Department of Railway Engineering was organized in 1906. The car was 45 feet in length over all, and was equipped with four 50-horsepower Westinghouse direct-current motors. The electric contact equipment was a Westinghouse unit switch system of multiple control and consisted of a circuit breaker, switch grip, motor-control cut-out, limit switch, line relay, one set of grid resistance boxes, two storage batteries, and two master controllers. The car was amply provided, also with recording voltmeters, ammeters, and wattmeters, and with auxilliary measuring and recording devices which supplied automatically a graphical chart of voltage, current, power, speed, acceleration, and time.

Through the courtesy of the Illinois Traction System, later the Illinois Terminal Railroad, the staff and students were enabled to perform experimental work with the car on the lines of this interurban road that reached the University campus,- investigations that provided much valuable information not only for student and University use, but also for the railroad company itself.

The car was housed in the north bay of the Mechanical Engineering Laboratory

Building during 1907-09,- until the first unit of the Mathews Avenue Power Plant was placed under construction. After that a spur was taken from the Boneyard Power Plant track to run into the Mathews Avenue plant immediately west of the electric units. This track was removed in 1919, when the building was extended for installing additional second units of boilers in the Mathews Avenue Plant. After that the car was kept on a track immediately north of the Locomotive Laboratory.

When the Department of Railway Engineering was discontinued in 1940, the car was returned to the Department of Electrical Engineering under the immediate charge of Professor Tuthill, but it was scrapped late in 1944 because of lack of track outlet facilities.

Drop-Test Machine.- A drop-test machine of the standard design of the Master Car Builders' Association and the American Railway Engineering Association, was built for the University during the school year 1908-09 by the Big Four Railway[1] at its Urbana shops from drawings furnished by the Pennsylvania Railroad. The machine was constructed for use in testing car axles, car couplers, coupler knuckles, knuckle pins, draft gear, and rails and rail joints. It consists essentially of a hammer weighing 1640 pounds that moves between two upright guides fifty feet in height, between which it is allowed to fall upon the specimen to be tested. The anvil of the machine weighs about 18,000 pounds and is supported by springs resting upon a concrete base.

Air-Brake Equipment.[2]- An arrangement of Westinghouse air-brake apparatus designed primarily for instructional purposes, and arranged in series with the New York equipment already on hand was installed during the school year 1909-10 in the Mechanical Engineering Laboratory. In addition to covering all the current designs for the usual engine, passenger, and freight service, the equipment included the following features: Combination automatic and straight air, duplex main reservoir control, double pressure control, the "High-speed" brake, retarded release and recharge tuples, the "E.T." (improved engine and tender) equipment, and a "St. Clair" car equipment complete.

1 The Big Four donated its services in this connection making a gift to the University of about six hundred dollars.

2 "New Railway Mechanical Equipment", the Technograph, 1909-10, page 125.

Sectional models of all parts were included. These were connected when possible in tandem with operating parts so that the operations of internal parts was visible. In erecting the apparatus, liberal use was made of by-passes, cocks and gauges for illustrating defects in the usual manner. In addition, provision was made for showing the building up and down of various pressures in serial action in order to demonstrate to the students as clearly as possible the points which were then occupying the attention of railroad clubs, and of air-brake instructors in connection with the handling of long heavy trains in severe service.

The plant was dismanteled in 1916 at the time of the remodelling of the Mechanical Engineering Laboratory. It was reassembled in the Brake Shoe Laboratory in 1924, and it was kept there until it was scrapped in 1941.

Signal Equipment.- A four-lever Saxby and Farmer interlocking machine was received by purchases from the General Railway Signal Company in 1924-25 to be used for instructional purposes in connection with the course in railway signaling. At that time, also, there was acquired a top-post automatic signal built by the same company, that was made to operate on 110-volt alternating current. During that same year, the Department purchased a model of a two-lever electro-pneumatic interlocking machine and switch mechanism manufactured by the Union Switch and Signal Company. All of these machines were set up in the south corridor of the main floor of the Transportation Building. In addition, there was obtained then a 110-volt, three-phase, alternating current relay for the electro-pneumatic interlocking machine and a six-volt, alternating-current, track relay of the vane type.

This equipment was transferred to the Department of Civil Engineering when the Department of Railway Engineering was discontinued in 1940, although it continued to remain in the Transportation Building.

F. MUSEUM MATERIALS AND COLLECTIONS

Drawings.- The Department brought together a large collection of blueprints representing different types and makes of locomotives, cars, and other rolling equipment, and different types of track and signaling equipment used in American practice. Much of this material was discarded shortly after 1940.

Photographs.- Beginning in 1912, the Department began to assemble and to hang in the corridors of the Transportation Building, large-size photographs of locomotives, cars, track structures and other railway equipment. This collection developed into an unusual accumulation of illustrative materials representing the development of rail transportation in this country and abroad.

Model Valve Gears.- The department had two model locomotive valve gears that stood in the east corridor of the Transportation Building. One of these was a Walscheart gear and American Balance Valve made by students in the University shops in 1911. The other was a model of a Baker valve gear secured in 1917.

The Chicago & North Western Railway Locomotive Testing Plant.- On June 6, 1910, the Chicago & North Western Railroad Company shipped to the University at Urbana, the old locomotive testing plant that it had formerly used to test its locomotives. This plant, the first of its kind ever to be built in this country, had been installed in the Fortieth Street, Chicago, Shops of that company, but had been out of service for some time. It was presented to the University as a gift.

The plant, built in 1894, was designed and operated under supervision of William A. Quayle, Superintendent of Motive Power. It was an outgrowth of earlier attempts Mr. Quayle had made by turning car trucks upside down to support a locomotive so that the mechanism could run while the locomotive itself remained stationary. There were three pairs of wheels to support the three pairs of driving wheels of locomotives of that day. The brakes that absorbed the energy had a capacity of 250 horsepower per axle. Mr. Quayle served on a research committee of the American Railway Master Mechanics Association, and the results of the tests he made with the plant contributed important information regarding the performance of steam locomotives.

The equipment was never used here for testing purposes, but some time after it was received, it was set up as museum material to illustrate a step in the development of locomotive testing plant. It was assembled behind the Transportation Building just as it had stood when in service on the North Western Line. The plant was dismantled in September, 1942, however, and contributed as scrap during the drive for metals needed for war purposes.

Richmond Locomotive.- A full-size front end of a two-cylinder, compound locomotive was given to the University by the American Locomotive Company in 1909. The exhibit included a pair of full-size cylinders equipped with intercepting valve bolted up as in actual practice. The full arrangement of steam and exhaust piping normal to the locomotive was provided in the front end so that students could see at a glance the construction of this type of locomotive.[1] This was also sacrificed to the war scrap metal drive in October, 1942.

Collection of Steel Rails.- A collection of rail sections representing the develop- of steel rails on lines in America, was brought togeter during the lifetime of the Department and maintained in the east corridor of the Transportation Building. There were fifty-five pieces in the set including rail sections two feet in length from the earliest and lightest to the latest and heaviest used in American practice. This exhibit was always a source of interest to students and visitors alike, for it impressively demonstrated the progress made in the improvement of steel rails used in American transportation service. This collection was delivered to the Department of Civil Engineering in 1940, but continued to remain in the Transportation Building.

G. FACULTY PERSONNEL

General.- Brief biographical sketches of faculty members above the grade of assis- tant that were connected with the Department of Railway Engineering, are listed in on the following pages in chronological order according to rank.

a. HEADS OF THE DEPARTMENT

General.- Only three persons served as Head of the Department of Railway Engineering during the lifetime of that organization. Dean Goss was head from its beginning in 1906 until 1910, Professor Edward Charles Schmidt, from 1910 until 1917, and again from 1919 until 1940, and Professor John McBeath Snodgrass from 1917 until 1919 during the absence of Professor Schmidt. The biographical sketch of Dean Goss is given elsewhere; those of the other two follow.

Edward Charles Schmidt was born in Jersey City, New Jersey, on May 14, 1874, and was graduated from the Mechanical-engineering curriculum of Stevens Institute of

1 Alumni Quarterly, 1909, Page 174.

Technology in 1895. After graduation, he was employed in mechanical-engineering practice until 1898, when he joined the staff of the University of Illinois as Instructor in Mechanical Engineering. From 1898 to 1903, he was successively Instructor and Assistant Professor here, but from 1903 to 1906, he was engaged in practice again. He returned to the University in 1906 as Associate Professor, and in 1910 became Professor of Railway Engineering in charge of the Department. In November, 1917, he left the University for military service as Major in the Ordnance Department; and on January 19, 1918, he was detailed for service under the U.S. Fuel Administration. From 1919 to 1921, Professor Schmidt was engaged as mechanical engineer with the North American Company in the operation of public utilities.. He returned to the University in September, 1921, and resumed his former position as Head of the Department of Railway Engineering. In September, 1912, Professor Schmidt was given a commission by the Imperial Government of Japan to assist in important railway construction work. One of the duties of his assignment was to design a steam dynamometer car for use on the Japanese railways. This car was built in the United States and delivered to the Japanese Government in the summer of 1914.

While he was connected with the University, Professor Schmidt directed many research projects in the field of railway mechanical engineering. He was author of two bulletins issued by the Engineering Experiment Station and was co-author of nine more. Early in 1940, he asked to be relieved of his University duties on account of ill health. His request was granted, and he was retired with the title of Professor of Railway Engineering, Emeritus. He took up his residence near New York City, with his daughter Katherine, where he died on March 21, 1942.

John McBeath Snodgrass was born on September 1, 1874, at Coldspring, Wisconsin, and was graduated with the degree of B.S. in Mechanical Engineering at the University of Illinois in 1902. He served as Instructor in Mechanical Engineering here from 1902 to 1906, when he left to work for the American Locomotive Company. He returned to the University in 1908 as Assistant Professor in the Department of Mechanical Engineering. He was transferred to the Department of Railway Engineering in September, 1912, as Assistant Professor of Railway Mechanical Engineering. Later, he became Associate

Professor and Professor of Railway Mechanical Engineering, and served as Acting Head of the Department during the absence of Professor Schmidt in 1917-19. He was author of two bulletins and joint author of six more, of the Engineering Experiment Station. He continued as Professor of Railway Mechanical Engineering until his death on December 4, 1926.

b. OTHER PROFESSORS

Everett Edgar King.- See Civil Engineering, Chapter VIII

James Theron Rood, (B.S., 1989, Worcester Polytechnic Institute; Ph. D., 1906, Clark University), served as Professor of Mathematics and Physics at Ursinus during 1906-07, Professor of Physics and Electrical Engineering and Head of the Department at the University of Alabama during 1907-09, and Professor of Electrical Engineering and Head of the Department at Lafayette College from 1909 to 1918. He came to the University of Illinois on September 1, 1918, to become Professor of Railway Electrical Engineering. He then went to the University of Wisconsin where he was Professor of Electrical Engineering from 1920 to 1929. After that, he served as Dean of Engineering at the New Mexico College of Agriculture and Mechanic Arts at Las Cruces until his death in 1934.

Everett Gilham Young.- See Mechanical Engineering, Chapter VII

c. ASSOCIATE PROFESSORS

John Kline Tuthill. See Electrical Engineering, Chapter XIV

Herman John Schrader.- See Theoretical and Applied Mechanics, Chapter XIII

d. ASSISTANT PROFESSORS

Shelby Saufley Roberts, (B. S., 1898, and C. E., 1907, Rose Polytechnic Institute), came to the University of Illinois in September, 1908, as Assistant Professor of Railway Civil Engineering, after having spent several years in railway service. He remained here until September, 1910, when he resigned to accept an appointment with the Interstate Commerce Commission. He obtained the degree of LL. B. from Washington Law School in 1925. Later he became Assistant Director, Bureau of Finance, with the Commission, and served in that position until his death in 1926. Professor Roberts was the author of a textbook entitled "Track Formulae and Tables."

c. ASSOCIATES

Edgar Isaac Wenger, (B.S., 1903, McGill University), spent his early years in practice. He served as Instructor in Electrical Engineering at the University of Illinois during 1905-06 and as Associate in Railway Engineering during 1906-09. He resigned to accept an appointment as Assistant Professor at McGill.

Franklin Wales Marquis, (B.S., 1905, and M.E., 1909, University of Illinois), was employed in practical work from 1905 to 1906, and then came to the University here as Assistant in Railway Engineering in the Engineering Experiment Station. He was made Associate in 1909 and retained that position until he resigned in 1913 to accept an appointment at Ohio State University. In 1929, he became Professor of Mechanical Engineering and Chairman of the Department there, and has retained that title to date. He is co-author of one bulletin issued by the Engineering Experiment Station here and of one at Ohio State.

Alonzo Morris Buck, (M.E., 1904, Cornell University; E.E., 1917, University of Illinois) was employed in engineering practice during 1904-05, was Instructor in Electrical Engineering at Cornell during 1905-06, and was engaged in engineering practice again during 1906-08. He then served as Assistant Professor of Electrical Engineering at New Hampshire University during 1908-10, and as Professor of Electrical Engineering at Clarkson College of Technology during 1910-11. He came to the University of Illinoi in September, 1911, as Assistant Professor of Railway Electrical Engineering and remained here in that position until the summer of 1917, when he resigned to re-enter engineering practice. Some years later, he became Engineering Editor of the Electric Railway Journal, now known as the Transit Journal. Professor Buck is author of a text-book entitled "The Electric Railway" and of one bulletin published by the Engineering Experiment Station here.

Arthur Francis Comstock, (B.S., 1906, and C.E., 1913, University of Illinois), was engaged in engineering practice after graduation until he came to the University of Illinois in September, 1912, as Instructor in Railway Civil Engineering. He became Associate in 1913, but resigned during the summer of 1917 to re-enter engineering practice.

Harold Houghton Dunn, (B.S., 1908, and M.S., 1915, University of Illinois), was engaged in engineering practice for several years after graduation and came to the University in 1911 as Assistant in Railway Engineering. He served in this capacity until 1917 when he became Research Associate in Railway Engineering. He resigned in September, 1920, to accept a position with the Westinghouse Electric and Manufacturing Company. Mr. Dunn is the author of one bulletin and co-author of two more, issued by the Engineering Experiment Station.

f. INSTRUCTORS AND RESEARCH ASSISTANTS

Albert St. John Williamson, (B.S., 1898, and M. E., 1902, University of Illinois), spent several years after graduation in railway mechanical engineering service, then joined the staff at the University in 1908 as Instructor in Railway Mechanical Engineering. He resigned in 1911 to accept employment in engineering practice. Mr. Williamson was author of many articles in the field of railway mechanical engineering published in the technical press.

Harry Cole Kendall, (B.S., 1904, University of Missouri; B.S., 1905, Massachusetts Institute of Technology), was employed from 1905 to 1909 in practical work. He served as Instructor in Railway Mechanical Engineering at the University of Illinois during 1909-11, after which he returned to practice in railway service.

Francis Seeley Foote, (E.M., 1905, Columbia University), spent two years in engineering practice following graduation, then served as Assistant in Columbia during 1907-10. He joined the staff at the University of Illinois in September, 1910, as Instructor in Railway Civil Engineering, but left the University in 1912 to become Associate Professor of Railway Engineering at the University of California.

Robert Browder Keller, (B.S., 1908, Purdue University), spent several years as an apprentice teacher and supervisor and came to the University of Illinois in 1913 as First Assistant in the Engineering Experiment Station. He resigned in 1915 to accept a position as Director of the O.S. Johnson Manual Training School. Mr. Keller is joint author of one bulletin of the Engineering Experiment Station.

Otto Sternoff Beyer, (M.E., 1907, Stevens Institute of Technology), spent several years in practice, then joined the staff at the University of Illinois and served

as Research Assistant during 1913-17. He resigned this position in 1917 to become Instructor in the U.S. School of Military Aeronautics at the University, and later received a commission as Captain in the Ordnance Reserve Corps. He is co-author of one bulletin of the Engineering Experiment Station.

Harold Nevins Parkinson, (B.S., 1918, Purdue University), was engaged in railway service after graduation until he came to the University of Illinois in January, 1921, as Instructor in Railway Mechanical Engineering. He left the University in September, 1925, to re-enter railway practice.

Frederick Roy Mitchell, (B.S., 1917, and E.M., 1917, Michigan College of Mines) became Research Assistant in Railway Engineering in January, 1922, but resigned in January, 1924, to enter engineering practice in the steel industry at Birmingham, Alabama.

David Lewis Fiske, (B.S., 1920, Massachusetts Institute of Technology; M. S., 1924, University of Illinois), became Research Assistant in Railway Engineering in September, 1924, but resigned in September, 1927, to accept a position as Secretary of the American Society of Refrigerating Engineers, which position he has held to date.

Clifford Ellis Morgan, (B.S., 1927, University of Idaho), served as Special Research Assistant in Railway Engineering during 1931-32.

H. DISCONTINUATION OF THE DEPARTMENT

General.- It was expected that the unparalleled facilities provided by the Department of Railway Engineering together with the other well-known extensive equipment of the College of Engineering, would quickly attract a considerable number of students desiring to enter railway service; but in this the University authorities were greviously disappointed. The number seeking instruction in these subjects scarcely justified the attempt particularly considering the very great number of men employed by the railways in these lines.

This lack of popularity of the curricula in railway engineering was not due to the professional activity of the members of the staff of this Department, for they published 22 bulletins and Circulars of the Engineering Experiment Station giving results of important investigations in fields in which there was a dearth of reliable

data; and these publications uniformly received the highest praise from railway officials. The results published in these bulletins was justification for all the money spent for equipment and for the conduct of the investigations; but the University had hoped also to educate many students who would render effective service to the railways and possibly add to their efficiency and value to the public. Apparently, these publications were more potent, proportionally, in attracting students from China, Japan, and South America than from our own country.

Again the lack of popularity of these curricula was not due to the fact that graduates from other departments of the College had not attained reasonable success in railway circles, for many of such graduates had been able to secure responsible positions in railway service. Furthermore, the unpopularity of the curricula could not be ascribed to the lack of success of graduates of the Department of Railway Engineering, for considering the small number of graduates, the showing was reasonably satisfactory.

Possibly one reason for the lack of popularity of the curricula in railway engineering was that there was no recognized profession of railway engineering, or of railway civil engineering, etc., and consequently there was no professional tie or lure to these curricula. In addition, after the establishment of the railway-engineering curricula, the railways were nearly continuously under the harrow through adverse financial conditions and restrictive legislation. Consequently, they did not expand their forces, but rather decreased them, nor did they do any construction work that could be postponed. Due to these situations, students and graduates found more difficulty in getting employment in railway service and received lower remuneration than in other lines; and these circumstances served to decrease the popularity of railway service. Then, too, in some branches of railway work, the officials did not give serious recognition to the fact that one or more years in an engineering college develops the intellectual powers of the student so as to fit him to make more rapid progress than one who has not had such technical training, and consequently that it is an injustice to engineering students and graduates to require them to give as much time to apprentice courses as those who have had no such training and for whom such a course may be entirely appropriate.

Whatever the reason or reasons for the small enrollment, the registration continued to be light until in February, 1940, the Department was ordered to be dissolved, effective September 1 following; for Professor Schmidt, who had been connected with the Department since its beginning except for a period of approximately two years at about the time of World War I, had asked to be retired on accout of ill health. The courses in the three divisions were revised and the number of subjects was somewhat reduced. The work in railway civil engineering was transferred to the Department of Civil Engineering, that in railway electrical engineering to the Department of Electrical Engineering, and that in railway mechanical engineering to the Department of Mechanical Engineering. The laboratory equipment was also transferred to the respective departments except that the brake-shoe laboratory was turned over to the Department of Theoretical and Applied Mechanics because of the experimental work being done at that time.

CHAPTER XVI

DEPARTMENT OF CERAMIC ENGINEERING

A. ORGANIZATION OF THE DEPARTMENT

General.- In earlier times, the term ceramics dealt with the making of pottery and pottery products. As used in modern industry, however, it has gradually acquired a much wider significance, and is generally applied now to the technology of practically all of the earthy or non-metallic minerals; that is, of nearly all mineral products except ores, and minerals of organic origin. The ceramic industries thus embrace the manufacture of all kinds of clay products, cements, glasswares, enamels, glazes, and abrasive materials.

Ceramic education at the University of Illinois owes its origin to a plan originated and formulated in 1894 by Professor Charles Wesley Rolfe, who was at that time Professor of Geology. He conceived the idea of establishing a "Laboratory of Economic Geology" at the University and prepared a small printed circular which discussed the desirability for state aid in the investigations and development of the mineral resources of the State. In the "Bill for an Act to Establish a Laboratory of Economic Geology", which he brought out, he specified that the direcotr of the proposed laboratory should collect samples of coal, clay, building stones, materials for the manufacture of glass, limes, cements, subject these samples to such analysis and combinations as will demonstrate their valuable properties; publish bulletins and make a collection of raw materials and products. While the bill did not specificially mention instruction, yet it would have been an easy and logical procedure to use the staff and laboratories for the purposo. That, in fact, was the intention.

This bill had the hearty support of the ceramic industries of the state. The President of the University approved the idea in principle, but the time seemed inopportune to undertake the project. Thereupon, Professor Rolfe was obliged to let the matter lie dormant until 1905 when President James, who had recently been installed, sanctioned the plan and urged him to proceed with the undertaking. A vigorous campaign was launched to secure favorable action by the General Assembly. Again Professor Rolfe had the strong support of the Illinois Clay Manufactures' Association, an organization

which was thoroughly familiar with the situation, which had a broad vision of its own importance, and which saw the need for an adequate training of young men who could be called upon to take leadership in the development of the industry and of the clay resources of the State. These men realized the dependence of modern civilization upon ceramics for the materials necessary in industrial enterprises, in engineering projects, and in the ordinary needs of life. Industrial expansion had made large demands upon the ceramic industries which they were not fully prepared to meet. For centuries the craft had been shrouded in mystery, and rule-of-thumb methods and great secrecy concerning processes prevailed. Since other industries had profited through the employment of technically-trained men, it seemed evident that such training was fundamental to the future success of the clay working interests

The bill was passed in due course, and the Deparmtnet of Ceramics was authorized on December, 10, 1905. The work in Ceramics was instituted at once; and for the academic years of 1905-10, courses in Ceramics and Ceramic Engineering were given under the direction of the Department of Geology in the College of Science. These two curricula were somewhat similar except that the latter contained more subjects in engineering. For the years 1910-15, the courses were under the direction of a separate Department of Ceramics, also in the College of Science. Since September, 1915, however, the work has been administered by the Department of Ceramic Engineering in the College of Engineering.

B. AIMS AND OBJECTIVES

General.- The following article taken from a University bulletin published at the time of the founding of the Department of Ceramics states very clearly the object and aims of the courses offered.

"The study of ceramics has to do with the application of physical science to the manufacture of wares made wholly or in part from clay. The conditions under which ceramic products may be successfully and profitably produced are so complex and exacting as to require special scientific training for the prospective ceramist. Low interest rates and cheap transportation have so broadened the field of competition that each manufacturer must look sharply to the quality of his wares and to the cost

of production. He must not only know the qualities of the materials he is using and of all other deposits so situated that they may possibly be of commercial use, but he must know what changes he can produce in his wares by various mixtures in body or glaze or by changes in method of treatment.

"He must know what machinery, what fuel, and what ways of handling are best suited to the materials he must use, what grades of ware he can produce and the cost of each. He must not only have this information in regard to the materials he can obtain on a commercial basis, but also like information concerning those within the reach of each of his competitors, if he would enter successful competition with them.

"Reliable information and scientific training along the lines indicated above are not easily gained by a young man through apprenticeship, no matter how large the factory in which he may be employed, nor even by expert service in some one department of the industry in several factories; but the training may be acquired in a comparatively short time through a well-balanced course of study properly supplemented by practical work. The best preparation for the management of large ceramic interests is not to be found in the factory or in the yards, but in the school with courses and equipment especially adapted to the purpose, and under instructors with broad training.

"This does not mean that ability to manage successfully any large business enterprice can be acquired in school. There is a large element of practical experience which can only be obtained by actual contact with the business world and with the details of the special line of business in which one embarks. The school ought to give the student mental strength, knowledge of principles and methods, skill in the manipulation of apparatus, training in scientific methods of experimentation and in the interpretation of results, familiarity with fundamental processes covering the whole field of research with which he is engaged, and then turn him into practical life while he still retains the plasticity of character to enable him to adapt himself to the conditions which he will meet in the particular branch of industry to which he shall devote himself.

"It is not expected that the student upon graduation will be able to manage successfully a large manufacturing plant. It is expected, however, that he will be in position to acquire this ability very rapidly when brought in practical contact with the problems of the factory, and that having reached this stage he will thereafter be stronger and in every way more capable than he could have been if he had not come under the influence of the school."[1]

C. THE DEVELOPMENT OF OFFICE, CLASS-ROOM, AND LABORATORY ACCOMMODATIONS

General.- When the department was inaugurated in 1905, it was provided with two rooms in the basement of Natural History Building. As a special provision had to be made fo the kilns, a small brick building about twenty feet square was erected, which was arranged to house not only the two kilns, but also the grinding equipment and the dry pan. This structure, still in existence, stands at the northwest corner of the Physic Building, immediately across the driveway from the University Fire Station, and for a number of years, it has been used as a garage. In 1909, the Illinois Clay Manufacture Association issued a circular which stated that the department was obliged to use "a room or two in the basements of each of three buildings scattered over a distance of three city blocks". This condition was relieved by the erection in 1910 of a two-story L-shaped brick

1"Courses in Ceramics at the University of Illinois", Bulletin, U. of I. Vol. III, Nov. 1, 1905, No. 3, pages 7-8

building with basement, having a total floor space of 6036 square feet. This building was located on the north side of th Bone Yard directly north of the kiln house, and was built as an addition to the Mechanical Engineering Laboratory. The catalogues of 1909-10 and 1910-11 described the Ceramics Laboratory as a two-story brick building in which were provided a general laboratory, plaster room, pottery room, rough-grinding room, machine room, drawing room, library, recitation room, chemical laboratory, and office, all equipped with appropriate apparatus. Although this structure allowed an immediate expansion of equipment, it soon became inadequate for the departmental purposes.[1]

In 1912, a one-story L-shaped, brick building was erected immediately east of the Transportation Building, one portion of which was arranged for office, classroom, and laboratory and kiln-house use, as the first unit of a new ceramics plant,- the other portion being assigned to the Department of Mining Engineering for laboratory purposes.

In 1915-16, the present Ceramics Building on Goodwin Avenue was constructed, and a corridor connection was made to the kiln-house previously mentioned. When the Department of Ceramic Engineering moved in the fall of 1916 into this new building from its quarters in the old Ceramics Building at the southwest corner of the Mechanical Engineering Laboratory, it took over most of the basement as a storage and plaster shop, and a large portion of the first floor for a clay shop, a store room, and offices and ceramic-materials laboratories. It occupied all of the second floor, using a suite of two rooms for the department office and an adjoining room for the museum in which were displayed ceramic wares and samples of raw materials. The southwest corner room was used for the departmental library, in which was provided not only books but also ceramic journals and magazines. Other rooms there were assigned for office use and still others for laboratory purposes in connection with chemical and physical work and high-temperature investigations. After the U.S. Bureau of mines moved out of the building on January 1, 1926, the Department took

1 It is interesting to note that this space was later utilized by the Department of Civil Engineering for a materials-testing laboratory and still later it was incorporated into the Mechanical Engineering Laboratory, it being located at the southwest corner of that building.

over the rooms at the north end of the third floor thus vacated for office use and for laboratory space for work in microscopy, pyrometry, and therma-expansion studies.

When the Department of Theoretical and Applied Mechanics moved its equipment from the Ceramics Building in 1929, the Department of Ceramic Engineering took over the large two-story laboratory it vacated at the northeast corner of the building, remodelled it somewhat, and thereby provided good laboratory space in the basement and additional laboratories on the main floor.

D. DEVELOPMENT OF LABORATORY FACILITIES[1]

General.- The laboratory equipment that has been assembled by the Department throughout the years since its inception in 1905, has been designed to offer to the students an opportunity to acquire some understanding of the properties of clay materials and other related mineral resources and to gain some proficiency in the utilization of facilities commonly employed in the ceramics industry. In addition, it has served to provide the means for the conduct of experimentation by advanced students and faculty on problems of particular interest or importance to the profession or to the users and producers of ceramic products. Some of the special laboratories are described briefly under the following headings.

Ceramic-Materials Laboratory.- The present ceramic-materials laboratory installed when the Ceramics Building was completed in 1916, is supplied with laboratory tables and lockers, balances, and other facilites needed in the study of the physical and chemical properties of clay and other ceramic raw materials and the identification and classification of the varieties usually found in commercial work. The eight large tables furnish locker space for eighty students and working space for forty at one time,- each individual being supplied with apparatus for independent work in order to develop initiative and self-reliance as well as to provide experience in this particular field.

In addition to the facilities for the preparation of test specimens, there have been accumulated equipment for special physical tests such as furnaces for determining the thermal expansion of bodies and for making thermal analyses of clays, machines

1 Much of the materials in this section was taken from a manuscript prepared by R.L. Cook, Associate in Ceramic Engineering.

for testing the dry and burned strength of products, equipment for measuring the modulus of elasticity of claypieces, and such particular apparatus as an Endell plasticimeter for measuring plasticity and an autoclave for testing glazed ware for delayed crazing.

In an adjacent room there has been provided ball mills of various sizes, blungers and stirrers for preparing bodies and glazes, a ferromagnetic filter and two automatically-controlled drying cabinets. In the basement there has been accumulated such grinding equipment as jaw crushers, roll mills, and disk mills that are used in the preparation of clays for laboratory work.

Supplies of equipment for classroom use are issued from the storeroom which is located on the first floor adjacent to the laboratory and which is connected directly with the weighing room that contains the working supplies of raw materials. Reserves of ceramic materials are kept in storage bins in the basement. Near by is an apparatus room where equipment for class experimental work and for research is stored when not in use.

<u>Pottery Laboratory.-</u> The pottery laboratory, used for instruction in the preparation of body mixtures and for demonstration and practice in the various methods of pottery and chinaware or tableware production, as well as for making special articles necessary for class and research work, has been equipped from time to time with such modern appliances as are found in commercial service.

The slip-house apparatus includes mixing units consisting of blungers, agitators, cleaning equipment, a filter press with a capacity of from 100 to 600 pounds of clay per batch and a smaller unit with a capacity of from 30 to 40 pounds of clay per charge. The molding equipment includes a throwing wheel, jigger, and pull-down lathe, and a number of casting and pressing benches and tile presses, permitting operations of different types used in commercial manufacture of various pottery products. In addition, there is a plaster shop for the use of the potter in making molds and other regular and special articles for use in the classroom and research projects of the Department.

<u>Enamel Laboratory.-</u> When the Ceramics Building was completed in 1916, the enamel

laboratory was installed on the first floor at the south end of the building. The equipment was gradually extended to include facilities for instruction and research in all branches of vitreous or porcelain enameling. These facilities comprise apparatus for chemical cleaning, pickling, annealing, scaling, and sandblasting of iron. They include, also, a battery of seven-gas fired crucible pot furnaces, each with a capacity of three pounds per melt. There are, in addition, two commercial types of rotary furnaces for smelting enamels, each having a capacity of sixty pounds of material. Besides, there is a five-pound and a one-pound electrically-heated smelter with automatic temperature control for use in research work. Furthermore, there has been added a tank type of furnace, fired by gas with the flame passing directly over the batch, as in commercial smelters, that produces about sixty pounds per melt.

For the milling of enamels, various sizes of machines have been made available, including small one-pound laboratory mills, regular four-pound mills, fifteen-pound mills, and one of one hundred-pounds capacity. Facilities are available for checking fineness, pick-up, specific gravity, and consistency by either the Bingham Consistometer, Irwin Plastometer, or the Gardner Mobilometer. A Franz-Ferro magnetic filter is used for extracting iron from the milled enamel, and a Rotospray is available for screening the milled enamel. Enamels are applied by dipping and spraying, the equipment for the latter consisting of a modern water-wash spray booth with both pressure and suction type of spray equipment.

The enamels are fired in electric furnaces of the chromel resistance type,-two of the furnaces having burning chambers 5 by 8 by 13 inches inside, one 9 by 12 by 24 inches, another 9 by 19 by 24 inches, and still another, located in the kiln house, 13 by 20 by 34 inches. These are controlled by automatic recording pyrometers.

The apparatus provided for testing the finished enamel surface includes a U.S. Bureau of Standards impact machine, a Lindemann-Danielson bonding test machine, a Gardner Magna gauge, a General Electric thickness gauge, a U.S. Bureau of Standards gouging machine, and such special apparatus as RCA Jr. Volt-Ohmyst and Cesco tester for measuring the continuity of enamel surfaces. The General Electric spectrophotometric photometer and a Hunter multipurpose reflectometer are used for determinations

of color and opacity, and the ultrapac microscope and the X-ray equipment are available for determinations of crystalline structure. The interferometer is used to study the coefficients of expansion of enamels, and a specially-designed machine for the tensile strength and elasticity. In addition, the testing equipment which has been developed under a cooperative project sponsored by the Enameled Utensils Manufactuers' Council is available for testing all kinds of enameled utensils.

Kiln Laboratory.- A 42 by 100-foot portion of the kiln-house, which was erected in 1911-12 as previously stated, has been devoted to the housing of kilns and furnaces of various types used for both instructional and experimental purposes. The largest kilns have been fitted with both oil- and coal-firing apparatus, and have ranged from one to three cubic yards capacity, in which it has been possible to develop temperatures as high as 2,600 degrees F or more, one going as high as 3,100 degreesF. Some of these were arranged for either up-draft or down-draft firing, but at this time all are of the down-draft type. Several smaller kilns have been constructed for firing individual batches, in some of which it has been possible to develop temperatures of 2,700 degrees F. Small gas-fired furnaces have been provided for conducting high-temperature fusion tests of refractories,-one furnace being capable of developing a temperature of 3,100 degrees F. for the testing of refractories under load. One rotating kiln was supplied for testing the resistance of fire brick to coal-ash and other slags, the powdered slag being fed through the gas burner so as to impinge and fuse on the test brick that form the lining of the furnace. Another furnace for this same purpose has been developed in which the burner rotates while the furnace remains stationary, a type which is now considered to be the standard for such experimental use. Two rotary smelting furnaces of 60-pounds capacity were added for making semi-plant size enamel frit batches and also for studying smelting processes. The equipment includes also, a battery of nine small frit furnaces and a number of small fusion furnaces for classroom and experimental service.

A 12-point wall set of indicating and recording pyrometers with compensating leads for both base and nobel metal thermocouples was installed in an adjacent room as a part of the pyrometer equipment of the kilns and furnaces. This

arrangement permits any kiln or furnace to be connected so that readings may be taken at great convenience, without the use of portable instruments. A recording carbon dioxide meter of the electrical resistance type, has been installed for the determination of atmosphere combustion conditions in the larger kilns.

There was recently installed one 26-kilowatt and one 36-kilowatt Box type enameling furnace made of alloy 10 that can be operated at 2,300 degrees F. for use in enameling and in firing glazes. There has also been recently added a cleaning and pickling room with complete tanking and ventilating equipment, and a special Kolene molten salt electrolytic cleaning set.

Structural Clay-Products Laboratory.- When the kiln house was completed in 1912, one end was taken over for a structural clay-products laboratory, and has been utilized for that purpose to date. The laboratory equipment gradually built up since then, includes a commercial size brick-making unit capable of turning out 1,000 brick per hour, comprised of a five-foot dry pan for grinding, a five-foot wet pan for tempering clay batches, an elevator, a vibrating screen for sizing, a pug mill, an augur brick machine and dies, and a hand-operated cutter. There is also provided a small augur machine for making hollow tiles, drain tiles, roof tiles, and bars, a small de-airing unit, a Simpson mixer, a 7 by 10-inch jaw crusher, a hand-power sagger press, a hand-power repress, a dryer, a 50,000-pound capacity hydraulic press, and a number of small plunger presses. A series of bins located along one of the walls of the laboratory provide storage space for clay, coal, fire brick, and saggers.

Drying Laboratory.- A Carrier drying cabinet equipped with forced-air circulation and automatic control of temperature and relative humidity has been provided for experimental work on the drying of clay products and in the determination of the fundamental principles involved in drying. A scale model of a progressive indirectly-heated drying tunnel constructed some years ago for the study of air movements and circulation in dryers of this type, is still on hand, although it is no longer used for this purpose.

Microscopic Laboratory.- The microscopic laboratory has been gradually fitted for use in both instructional and experimental work in the conduct of intensive studies of the physical structure of ceramic raw materials and ceramic products, large collections of which are available. Among the new and used ceramic products, the samples of refractories after use in glassmelting furnaces are especially complete. From this assemblage of products more than 1,000 thin sections have been prepared and are available for laboratory purposes. The special laboratory equipment includes a combination lathe for sawing and polishing microscopic sections, two research petrographic microscopes, and seven student petrographic microscopes. The special apparatus consists of a photomicrographic camera supplied with three lenses for doing also photographic work at low magnification; accessory facilities and lenses fitted for reflected light illumination for study of polished opaque surfaces; a filarmicrometer and euscope for measurement of small particles; a parabaloid condenser for dark field work; and a cardiod condenser for study of materials of colloidal size. There have been provided, too, a number of small electric furnaces for the preparation of artificial minerals.

Glass Technology Laboratory.- A complete assortment of equipment has been brought together for instructional and experimental purposes in connection with the study of glass and glassy silicates and the properties of fused and solidified glases. The apparatus includes gas-fired furnaces operating at temperatures up to 1,650 degrees C. and electric Globar-element furnaces which may be used up to 1,500 degrees C. It includes, also, molds and presses used in the production of glass test pieces, complete grinding and polishing facilities for the preparation of test samples, and appliances for the special study of the softening point by Littleton's method, of the electrical conductivity of glass, and of the surface tension of molten glass. In addition, there has been provided equipment including both polariscopes and a Cabinet compensator, for determination of strains in glasses, and apparatus of both the interferometer and the fiber-comparison types for the determination of the thermal expansion of glasses. Furthermore, there has been added apparatus for studying the chemical durability of glass, for making solarization tests by the

quarts-mercury arc, for conducting flourescence studies and for determining the transmission of colored glass, for testing the surface hardness of glass, and for examining the resistance to thermal shock of various types of glasses.

Research Laboratories.- Several research Laboratories have been fitted up by the Department for the study of the properties of such raw materials as clays, feldspars, and quartz, and for conducting experimental work on such semi-finished and finished products as glasses, enamels, glazes, porcelain bodies, refractory materials and products, plasters, and cements of various types. Since much of the investigational work must be carried on at high temperatures, there has been assembled a number of furnaces capable of close temperature regulation, some with atmospheric control, for use in the accurate determination of such physical properties of materials and products as the melting point, specific heat and thermal expansion and contraction; in the identification and quantative determination of dissolved gases in glasses and enamels; in the examination of surface tension and electrical conductivity of glasses and enamels; and in the observation of physical and chemical changes of the materials at various temperatures. Other special apparatus includes an X-ray diffraction unit for the study of the crystalline structure of ceramic materials and products.

Besides the facilities maintained by this Department, the equipment of other departments here on the campus is accesible for research purposes. For example, the electron microscope, various spectrographs, colorimeters, and additional X-ray apparatus are available in the Department of Chemistry, and the spectrophotometric photometer in the Department of Electrical Engineering.

E. COLLECTIONS AND MUSEUM MATERIALS

General.- The Department of Ceramic Engineering has brought together an unusual collection of modern ceramic wares representing types of bodies, glasses, glazes, enamels, and other materials, and illustrating methods of decoration, - the special display of glasses including cut glass, art glass, fiber-cloth glass, and insulating materials; and that of enamels comprising a number of miscellaneous items illustrating the use of sheet-iron and cast-iron bases. An assortment of over 1,000 pieces

typical of American and foreign potteries, acquired through donation and purchase, demonstrates the range of the field of ceramic art. One piece of particular interest is the duplicate of the English Wedgewood bone plate made for ex-President Theodore Roosevelt.

One room originally set aside for the Ceramics Library, is given to a display of articles made in the Department here, to an accumulation of white wares such as porcelain and chinaware presented by the manufacturers, some of which are located in Illinois, and to an exhibit of the "Heinrich Reis Collection", a gift[1] by Heinrich Reis of fifty-three pieces of unusual and fine foreign pottery collected by him during his visits to the various countries of continental Europe.

Still other collections in the building include tiles, terra cotta, cements, abrasives, pottery, mosaics, unusual forms of chinaware, and a number of pieces of Indian ware. The Department has assembled, also, numerous samples of raw materials representing varieties of such products as are commonly found in commercial work. Of special note and interest is the fact that much of the face brick lining the corridors of the building itself, illustrates many of the different structural types made in industrial plants.

This elaborate display of exhibits serves to point out the developments in the field of ceramics and ceramic engineering better than any descriptive account could provide. It serves as a source of information for both students and visitors alike to indicate something of the scope of the ceramic industry and the progress that has been made in the production of materials from clay and related mineral resources and that have been so widely used for domestic and commercial purposes throughout the country.

---

1 Presented to the Department in November, 1944.

F. FACULTY PERSONNEL

General.- Brief biographical sketches of staff members of the grade of assistant or above that have been connected with the Department of Ceramic Engineering, are listed in the next few pages in chronological order according to rank.

a. Heads of the Department

General.- The work in Ceramics was first given in the College of Science in 1905 under the administration of Professor C. W. Rolfe, who served as general director until 1910,- Dr. Ross Coffin Purdy being in immediate charge during 1905-07. Albert Victor Bleininger was Director during 1907-08, 1910-12, and 1915-16,-Roy Thomas Stull

serving as Acting Director of the courses during the interim period 1912-15. When Professor Bleininger returned to the U.S. Bureau of Standards on February 1, 1916, following his leave of absence to direct the courses here, Ralph Kent Hursh assumed charge until the following September, when Dr. Edmund Wight Washburn was appointed Head. Doctor Washburn served until 1922, at which time Cullen Warner Parmelee became Head and continued in office until 1942. Andrew Irving Andrews then succeded him and has remained Head to date. Biographical sketches of these men foll

Charles Wesley Rolfe.- Although Charles Wesley Rolfe was never a member of the staff of the College of Engineering, a brief biographical sketch of his life is entirely appropriate in this publication, for he was largely responsible for the initial steps taken in founding the Department of Ceramic Engineering and for the high level of instructional standards maintained in its several curricula.

Professor Rolfe was born at Arlington Heights, Illinois, on April 17, 1850. He was graduated from the University of Illinois with the degree of B.S. in 1872, and was granted the M.S. degree in 1876. He became Instructor in Mathematics and Botany at the University here in 1881. He served as Assistant Professor from 1883 to 1885 and Professor of Geology from 1885 until he was retired as Professor of Geology, Emeritus, September 1, 1917. After retirement, Professor Rolfe continued to make his home in Champaign until his death on April 6, 1934.

Ross Coffin Purdy was born in Jasper, New York, on March 3, 1875. Mr. Purdy was engaged in engineering practice until he joined the staff of Ohio State University as Assistant in Ceramics in 1902. He remained at Ohio until he came to the Universit of Illinois in 1905 to become the first instructor in Ceramics. He remained here in that position until 1907, when he returned to Ohio State University as Assistant Professor of Clay Working and Ceramics. He served as Professor of Ceramic Engineering there from 1909 to 1911. He returned to practice then and became General Secretary of the American Ceramic Society in 1922, and has remained in that position to date.

Professor Purdy received the degree of Cer. E. at Ohio State University in 1908 and the D. Sc. degree at Alfred University in 1935.

Albert Victor Bleininger was born on July 9, 1873, at Polling, Germany, and received the B.S. degree at Ohio State University in 1901. After three years in practice, he served as Assistant and then as Associate Professor of Ceramics at Ohio State during 1904-07. He was appointed as Assistant Professor of Ceramics at Illinois effective in September, 1907. During 1908-10, he was with the U.S. Geological Survey, but returned to the University as Professor of Ceramics and Director of the courses in Ceramics from 1910 to 1912. In 1912, Professor Bleininger left the University to go to the newly-created Laboratory of Clay Products of the U.S. Geological Survey. He returned to the University again, however, for a short period from September 1, 1915, to February 1, 1916, to take charge of the Department while on leave from the U.S. Bureau of Standards. While at the Bureau of Standards during World War I, Mr. Bleininger "through his skill and untiring energy did a marvelous work in the production of large quantities of most excellent optical glass,"- an article then greatly needed by the U.S. Army and Navy. Mr. Bleininger left the Bureau of Standards to join the Homer Laughlin Pottery Company about 1924.[1]

Ray Thomas Stull was born on March 12, 1875, at Elkland, Pennsylvania, and received the E.M. degree at Ohio State University in 1902. After graduation, Mr. Stull spent several years in ceramics parctice and joined the University in 1907, serving as Instructor in Ceramics during 1907-11, Associate during 1911-12, and as Acting Director during 1912-15. During his administration, the attendance reached a total of 84 undergraduate students. The Ceramics Short Course, an industrial program of two-weeks's duration for men in practice, which succeeded one of shorter duration conducted by the Department of Geology under Professor Rolfe, was instituted in 1913. In 1915, Professor Stull resigned to re-enter engineering practice. He continued in industry until 1927, when he became Chief of the Heavy Clay Products Section of the U.S. Bureau of Standards, a position he held until his death on January 5, 1944.

Edward Wight Washburn was born on May 10, 1881, at Beatrice, Nebraska. He received the B.S. degree at Massachusetts Institute of Technology in 1905 and the Ph.D. degree there in 1908. Mr. Washburn served as Research Associate at Massachusetts

1Professor Bleininger died on May 19, 1946.

Institute of Technology during 1906-08, as Associate in Chemistry at the University of Illinois during 1908-10, as Assistant Professor of Physical Chemistry during 1910-13, and as Professor of Physical Chemistry during 1913-22. In September,1916, Doctor Washburn became Head of the Department of Ceramic Engineering while still retaining the title of Professor of Physical Chemistry. Professor Washburn resigned in September, 1922, to become Chairman of the Division of Chemistry and Chemical Technology of the National Research Council. He also served as editor-in-chief of the International Critical Tables of Physical, Chemical, and Engineering Constants. From 1926 until his death on February 6, 1934, he was Chief Chemist of the U.S. Bureau of Standards. Professor Washburn was author of a textbook entitled "Introduction to the Principles of Physical Chemistry", and was co-author of two bulletins of the Engineering Experiment Station.

Cullen Warner Parmelee was born in Brooklyn, New York, on June 27, 1874. He received the B.S. degree from Rutgers University in 1896, being an honor student in chemistry, and was granted the M.S. degree there in 1926. Mr. Parmelee was engaged as a practicing chemist from 1896 to 1901. He was associated with Rutgers University in Chemistry and Ceramics from 1901, being Professor of Ceramics and Director of the Department of Ceramics from 1906 until 1916. He came to the University here in September, 1916, as Professor of Ceramic Engineering, becoming Acting Head of the Department in 1922 after the resignation of Professor Washburn, and Head in 1923.

Professor Parmelee has been active in the affairs of the American Ceramic Society serving as President of the organization during 1914-15. He has contributed many articles to the technical press, and is co-author of seven bulletins issued by the Engineering Experiment Station. In 1936, Rutgers honored him with the degree of D. Sc., and on September 25, 1937, the German Ceramic Society made him an honorary member of that association. In September, 1942, he reached the University age limit and retired with the title of Professor of Ceramic Engineering, Emeritus.

About the time of his retirement, Professor Parmelee was presented with a terra-cotta plaque at an alumni dinner attended by eighty-four former students, held in Cincinnati during a meeting of the American Ceramic Society. The plaque, later mounted in the east corridor of the Ceramics Building, bears the following inscription:

CULLEN WARNER PARMELEE
AN APPRECIATION OF HIS CONTRIBUTION TO CERAMIC
ENGINEERING EDUCATION AND TO THE TECHNOLOGY
OF THE CERAMIC INDUSTRY.
Erected by Alumni of the Department, 1942

At the same meeting Professor Parmelee was also presented with a bound volume of personal letters from 240 alumni and with a life membership in the American Ceramic Society. A scholarship has been named in Professor Parmelee's honor, as a tribute to him for his long period of faithful and efficient service to the University and the ceramics industry.

Andrew Irving Andrews.- was born in Baraboo, Wisconsin, on June 10, 1895. He received the B.S. degree at the University of Wisconsin in 1920, the M.S. degree there in 1921, and the Ph.D. degree at Ohio State University in 1924. He was Professor of Ceramic Engineering at Alfred University during 1924-25, after which he served as Assistant Professor at the University of Illinois during 1925-28, Associate Professor during 1928-32, and Professor of Ceramic Engineering 1932 to date. Doctor Andrews became Head of the Department of Ceramic Engineering here in September 1942, when Professor Parmelee retired.

Professor Andrews is author of a text entitled "Ceramic Tests and Calculations" and of another "Enamels", and is co-author with Ralph L. Cook of one Entitled "Enamel Laboratory Manual". In addition, he is author of one bulletin and is joint author of three more, of the Engineering Experiment Station. He served as Chairman of the Enamel Division of the American Ceramic Society in 1933 and as President of the Society in 1939.

b. OTHER PROFESSORS

Ralph Kent Hursh, (B.S. in M.E., 1908, University of Illinois). was associated with the U.S. Geological Survey and the U.S. Bureau of Standards during 1908-11. He

came to the University in 1911 as Instructor in Ceramics, and then became in turn, Associate, Assistant Professor, and Associate Professor of Ceramic Engineering. He was made Professor of Ceramic Engineering in 1929. During a time in 1916, after the Director of Courses in Ceramics had resigned, Professor Hursh was in charge. He was in charge, again, during the academic year 1930-31, when Professor Parmelee was on leave travelling and studying abroad. Professor Hursh is joint author of two circulars issued by the Engineering Experiment Station.

Dwight Granville Bennet, (B.S., 1930, University of Illinois), was employed in research and development work for industrial organizations and the Mellon Institute until he joined the staff at the University in August, 1943, as Special Research Professor of Ceramic Engineering on the cooperative investigation of Ceramic Coatings for Exhausts Disposal Systems.

c. ASSOCIATE PROFESSORS

Alfred Earl Badger, (B.S., 1922, Case School of Applied Science; M.S., 1929, and Ph.D., 1939, University of Illinois), joined the staff of the University of Illinois in September, 1927, as Special Research Assistant in Ceramic Engineering. He became Research Associate in 1935, Research Assistant Professor in 1940, and Research Associate Professor in 1942. Professor Badger is joint author of two bulletins published by the Engineering Experiment Station.

Clifford Martin Andrews, (B.S., 1934, University of Illinois), was engaged in industry until he joined the staff at the University of Illinois in August, 1943, as Special Research Assistant Professor of Ceramic Engineering in the cooperative investigation of Ceramic Coatings for Exhaust Disposal Systems. He was promoted to the rank of Special Research Associate Professor of Ceramic Engineering in September, 1944.

Frederick Adolph Petersen, (B. S., 1937, University of Illinois: M.S., 1939, Ohio State University), was engaged in practical work until September, 1942, when he became Special Research Associate in Ceramic Engineering at the University of Illinois. He was made Special Research Assistant Professor in 1943, and Special Research Associate Professor in 1944.

d. ASSISTANT PROFESSORS

Cameron Gerald Harman, (B.S., 1929, M.S., 1935, and Ph.D., 1939, University of Illinois), served as teacher and research worker at Iowa State College from 1929 to 1934. He joined the staff of the University of Illinois in September, 1936, as Instructor in Ceramic Engineering. In 1942, he became Assistant Professor and remained with the University until October, 1945. He is co-author of one bulletin of the Engineering Experiment Station.

Floyd Allen Hummel, (B.S., 1937, University of Illinois), was employed in the ceramic industry until he joined the staff at the University here in September, 1944, as Special Research Assistant Professor on the cooperative investigation of Ceramic Coatings for Disposal Systems. He also withdrew in October, 1945.

e. ASSOCIATES

Elmer Newman Bunting, (B.S., 1915, and Ph.D., 1918, University of Chicago), was engaged in engineering practice for a time until he came to the University of Illinois in January, 1920, as Research Associate in Ceramic Engineering. He remained here until February, 1924, when he resigned to re-enter engineering practice. He is co-author of one bulletin of the Engineering Experiment Station.

Albert Ernest Robert Westman, (B.A., 1921, M.A., 1922, and Ph.D., 1924, University of Toronto), joined the staff of the University of Illinois in September, 1924, as Research Associate in Ceramic Engineering. He resigned in September, 1928, to become Associate Professor in the Department of Ceramics at Rutgers University. Since 1929, Doctor Westman has been Director of Chemical Research, Ontario Research Foundation. He is author of two bulletins and is co-author of one more, of the Engineering Experiment Station.

Thomas Newkirk McVay, (B.S., 1914, M.S., 1926, and Ph.D., 1936, University of Illinois was engaged in engineering practice during 1914-22, and then came to the University as Instructor in Ceramic Engineering. He became Associate in 1926, but resigned in September, 1928, to take a position as Professor of Ceramics at the University of Alabama. He is author of one bulletin and co-author of one more, published by the Engineering Experiment Station.

Clyde Lowry Thompson, (B.S., 1927, M.S., 1930, and Ph.D., 1936, University of Illinoi. became Instructor in Ceramic Engineering at the University in September, 1928, and Associate in 1934. He resigned in September, 1936, to accept a position in engineering practice. He is author of one bulletin of the Engineering Experiment Station.

William Ray Morgan, (B.S., 1920, M.S., 1932, and Ph.D., 1937, University of Illinois), who from February, 1929, had been a Special Research Assistant, became Instructor in Ceramic Engineering in 1935 and Associate in 1936. He resigned in September, 1938, to join the staff of the Department of Ceramics at Rutgers University. He is author of two bulletins and one circular of the Engineering Experiment Station.

George Herbert Zink, (B.S., 1938, and M.S., 1942, University of Illinois), was appointed Assistant in Ceramic Engineering in September, 1938, Special Research Assistant in 1940, and Special Research Associate in 1941. He resigned in September, 1942, to enter military service.

Ralph LaVerne Cook, (B.S., 1934, University of Alabama; M.S., 1940, and Ph.D., 1944, University of Illinois), spent four years in practice before coming to the University in September, 1938, as Instructor in Ceramic Engineering. He was made Associate in 1943. He is co-author of a textbook entitled "Enamel Laboratory Manuel".

Howard Raymond Swift, (B.S., 1940, and M.S., 1943, University of Illinois), became Research Associate in Ceramic Engineering in September, 1943 but withdrew in September,1944

Louis Millard Doney, (B.S., 1940, University of Illinois), became Special Research Associate in Ceramic Engineering in September, 1943. He also withdrew in September, 1944, to accept an appointment in commercial work.

f. INSTRUCTORS AND RESEARCH ASSISTANTS

Junius Frederick Krehbiel, (B.S., 1904, Alfred University), joined the staff at the University of Illinois in 1906 as Instructor in Ceramics. He remained here only until the end of the school year, however, when he resigned to enter engineering Practice.

John McBride Knote, (A.B., 1904, Wittenberg College; A.M., 1906, Ohio State University) served as Instructor at Ohio State University during 1904-08. He came to the University of Illinois in 1908, as Instructor in Ceramics, and remained in that position until he withdrew in 1911.

Frank Miller Wallace, (B.S., 1911, University of Illinois), became Research Assistant at the University immediately after graduation, but withdrew at the end of the academic year to take up work in engineering practice.

George Howard Baldwin, (B.S., 1911, Rutgers University), was Research Assistant in Ceramics here during 1911-12.

Clarence Edward Fulton, (B.S., 1911, Rutgers University), was Research Assistant in Ceramics here during 1911-12.

Henry Harrison Bartells, (B.S., 1913, University of Illinois), served as Research Assistant in Ceramics during 1912-13.

Barney Simonson Radcliffe, (A.B., 1908, Miami University; M.S., 1910, University of Illinois), served some years in practice, then in 1915 joined the staff at the University of Illinois as Instructor in Ceramic Engineering. He remained here until 1916.

Arthur Edwards Williams, (B.S., 1910, and M.S., 1916, University of Illinois), spent some time in practice, then joined the staff at the University in 1915 as Instructor in Ceramics,-his special interest being in the field of glass. He remained here until 1916, when he resigned to accept an appointment with the U.S. Bureau of Standards, where he undertook the production of optical glass. During World War I this was a very important item on account of its limited supply, for up to that time it had been made almost exclusively in Germany. He achieved notable success in this endeavor. Later, he became Consulting Glass Technologist to the Hartford Empire Company, Hartford, Connecticut.

Howard Clinton Arnold, (B.S., 1914, University of Illinois; A.M., 1916, Ohio State University), was employed in engineering industry during 1914-16. He served as Instructor in Ceramic Engineering here during 1916-17, after which he resigned to enter defense work in World War I.

Frank Farnsworth Footitt, (A.B., 1914, Albion College; M.S., 1916, University of Illinois), Served as Research Assistant in Ceramic Engineering during 1917-18. He is joint author of one bulletin published by the Engineering Experiment Station.

John Elbert Seabright, (B.S., 1910, University of Virginia), was engaged in engineering practice until he was appointed to the staff at the University of Illinois

in February, 1918, for the second semester only, as Instructor in Ceramic Engineering.

Earl Emanuel Libman, (B.S., 1916, M.S., 1920, and Ph.D. (Physics) 1922, University of Illinois), spent one year in practice, then joined the staff at the University as Assistant in Ceramic Engineering in September, 1917. He became Instructor in 1921, but his appointment terminated in July, 1922, when he became a member of the staff of the Department of Mathematics here. Still later, he was appointed as a member of the staff in the Department of Physics (which see). Mr. Libman is author of two bulletins and is co-author of one more issued by the Engineering Experiment Station.

Austin Joseph Paul, (B.S., 1924, University of Illinois), served as Special Research Assistant in Ceramic Engineering here from September, 1926, to February, 1927.

Wilbur Henry Pfeiffer, (B.S., 1924, University of Illinois), was Special Research Assistant in Ceramic Engineering from September, 1926, to February, 1927. He is co-author of one bulletin published by the Engineering Experiment Station.

Chester Earl Grigsby, (B.S., 1925, University of Illinois), was Special Research Assistant in Ceramic Engineering during 1926-27. He is co-author of one circular of the Engineering Experiment Station.

George Alfred Ballam, (B.S., 1924, and M.S., 1915, University of Wisconsin), was Research Assistant in Ceramic Engineering here during 1928-29. He is co-author of one bulletin of the Engineering Experiment Station.

Emanuel A. Hertzell, (B.S. in Chemistry Engineering, 1925, Pennsylvania State College; M.S. in Chem. Eng., 1926, Carnegie Institute of Technology), served as Special Research Assistant in Ceramic Engineering during 1928-30. He is co-author of two bulletins of the Engineering Experiment Station.

Richard David Rudd, (B.S., 1927, and M.S., 1929, University of Illinois), served as Research Assistant in Ceramic Engineering from September to December, 1929.

Alfred James Monack, (B.S., 1927, University of West Virginia; M.S., 1929, University of Illinois), served as Special Research Assistant in Ceramic Engineering here from September, 1929, to March, 1932.

William Weber Coffeen, (B.S., 1935, and M.S., 1937, University of Illinois), served as Special Research Assistant in Ceramic Engineering here during 1935-37.

Brunham William King, (B.S. in M.E., 1931, Carnegie Institute of Technology; M.S., 1933, Ohio State University; and Ph.D., 1938, University of Illinois), became special Research Assistant in Ceramic Engineering in 1937, but resigned in July, 1941, to enter engineering practice.

Joseph Adam Pask, (B.S., 1934, and Ph.D., 1941, University of Illinois; M.S., 1935, University of Washington), was made Assistant in ceramic Engineering at the University of Illinois in February, 1937, and Instructor in September, 1938. He resigned in September, 1941, to become Assistant Professor of Ceramic Engineering and Acting Head of the Department at the University of Washington.

Harold Carl Johnson, (B.S., 1940, and M.S., 1942, University of Illinois), was appointed Special Research Assistant in Ceramic Engineering effective September, 1940, but left the University in 1942 to engage in engineering practice.

Eugene Darrel Lynch, (B.S., 1943, University of Illinois), became Special Research Assistant in Ceramic Engineering in September, 1943. He withdrew in October, 1945.

Gordon Harene Johnson, (B.S., 1944, University of Illinois), became Special Research Assistant in September, 1944, on the use of Strontium in Ceramics. He also withdrew in October, 1945.

G. MISCELLANEOUS

State Scholarships in Ceramics.- When the Department was organized in 1905, the Board of Trustees approved the policy that 102 free scholarships, one for each county, in the State, be granted in ceramics on the nomination of the Illinois Clay Manufacturers' Association[1]. This practice served to advertise the Department, and gradually more and more of the scholarships were applied for each year, but the increase was most rapid during the depression of 1929-35,- the maximum number of scholarships being assigned in 1934. Due to the necessity of reducing the number of free scholarships accepted by the University, these scholarships in Ceramics were discontinued effective at the beginning of the school year 1938-39. This resulted in marked decrease in the enrollment in ceramics and ceramic engineering during the years immediately following. In 1937, it was 72; in 1938, 24; and in 1939,

1. Minutes of the Board of Trustees, June 2, 1905.

24. To offset this decline, at least to some extent, a trust fund providing for scholarships in ceramic engineering was approved by the Board of Trustees in October, 1943. Appointments made on a merit basis, are for one year extendable an additional year to students who are interested in this particular field and who have sufficient money in addition to be able to attend at least two years.

Summary.- During the years of the existence of the Department of Ceramic Engineering, the members of its staff have shown an active participation in affairs of the national scientific societies representing the ceramic industries and have maintained a close cooperation with the manufacturers engaged in the production of ceramic products. Because of such contacts with individuals, firms and other organizations associated with the clay and related resources of the State, and Nation the Department has attracted a goodly number of students to the University to take instruction in this particular field. Its graduates, many of whom have chosen to continue in advanced work to secure their doctor's degree, making themselves thereby more valuable for careers in their chosen profession, have gone out to all parts of the country to assume positions of responsibility as teachers and research workers in educational institutions and as engineers in industrial and commercial practice. The departmental staff has been very successful, also, in the training of workers and administrative groups connected with the industry through its short courses and conferences which have been widely attended even by residents of other states and nations. Of no less importance, though, have been the contributions that have been made by faculty and graduate students through their investigational efforts in connection with the development of the clay and mineral resources of the State, whereby the staff has been able to demonstrate that many common earthy elements previously considered to be worthless commercially, could be processed to advantage in the production of high-grade construction materials. In addition, it has been able to develop many new processes used in the production of ceramic goods and to improve a number of those already established, thereby pointing the way to more economical use of clay and other raw materials in the development and utilization of the State's resources. As a result of all of these efforts, the Department has

moved into a position where the ceramic interests of the State can look with confidence for a supply of men trained in their particular field and for a satisfactory solution of such problems as may confront them in the rounds of their conventional practice.

CHAPTER XVII

THE DEPARTMENT OF GENERAL ENGINEERING DRAWING

A. ORGANIZATION

General.- In the early days of the University, mechanical drawing was designated projection drawing; and for two decades it and the elements of descriptive geometry were given to the freshmen, while the advanced descriptive geometry was given to juniors. Sometimes one subject was under the direction of one man, while the other was under another. Of course, this was a very unfortunate state of affairs, but during those days, the job of teaching mechanical drawing and descriptive geometry to freshman engineers, was like an unwelcome orphan among the children of the household, -- these subjects being the unwelcome and temporary addenda to the work of some instructor whose consuming ambitions were elsewhere. This condition was due partly to the straightened circumstances of the University's finances, and partly to a lack of the appreciation of the importance of the subject or of the opportunities the instructor in those subjects had of becoming acquainted with the freshmen and of influencing and helping them in a trying time of their college life. Consequently, no traditions were established, no adequate apparatus and facilities were accumulated, and no instructor acquired the experience necessary to guide the freshmen wisely and efficiently. During this period this subject was successively under the personal but temporary charge of N. C. Ricker, I. O. Baker, S. W. Stratton, and A. N. Talbot, all of whom were then, or shortly afterwards became, professors of other departments of instruction. At intervals during these years, and even subsequently, the teaching of this subject was committed, without much if any general supervision, to young and inexperienced instructors who for one reason or another continued in the work for only a brief period of time. Finally, however, mechanical drawing and descriptive geometry came to be grouped together under the title General Engineering Drawing, and were taught thereafter as a single unit running throughout the entire freshman year.

During the interval from 1908 to 1921, the work was in charge of the assistant dean of the College, who divided his time between the two assignments. In 1921, however, there was created a separate department of General Engineering

Drawing, for the increased enrollment of students and corresponding incr... in the size of the teaching staff, warranted the formation of an independent unit having the status of a department within the College. There was no change in the administrative plan, however, for Harvey H. Jordan, who had been serving as Assistant Dean and directing the work in drawing continued as Assistant Dean and Head of the Department of General Engineering Drawing.

A Service Organization.- While the Department of General Engineering Drawing has offered courses in drawing and descriptive geometry since the opening of the University, it has never offered a curriculum; and, of course, has never granted degrees, either baccalaureate or graduate. It is purely a service department for students in engineering, architecture, and other divisions of the University.

Aside from the educational value of these particular courses, the instruction serves to provide the first class-room contact which the young students get with members of the College faculty. The impressions which these beginners form thereby from their observations and clasroom experiences serve to some extent as a basis for decision regarding their aptitude, qualification, and abiding ability for carrying on engineering work, and as a measure of what may be expected of them in class-room and laboratory performance during later years. The members of the staff, therefore, possess the real opportunity not only of moulding the minds of these young men, but also of instilling in them the determination to achieve the purposes they set out to attain.

B. OBJECTIVES OF THE DEPARTMENT

Objectives of the Department.- The general objective of the course in General Engineering Drawing is to train the students in the selection, care and use of drafting equipment and in the step-by-step preparation of productive drawings of simple machines, structural parts of buildings, or other fabrications of an engineering nature. As stated in a Pictorial Description[1] "This department is organized to provide instruction in mechanical drawing, descriptive geometry and blueprinting which are required of all engineering students during their freshman year. It endeavors to familiarize the student with the use of drafting instruments in the execution of

1 "The College of Engineering and Engineering Experiment Station", 1919, page 10.

drawings demanding skill in their use and in free-hand lettering, together with a knowledge of tracing and blueprinting."

C. OFFICE, CLASSROOM AND DRAWING-ROOM QUARTERS

General.- The space assigned to General Engineering Drawing was on the top floor of University Hall until 1909, when the Department was transferred to 319 Engineering Hall[1],-a large room at that time occupying the entire north wing of the third floor. All sections meeting at one time were held in this one room. When the Transportation Building was completed in 1912, the Department was assigned the entire third floor of that building, but as the enrollment of the College of Engineering increased, it became necessary to secure additional space for classroom use. For instance, in 1919-20, the Department was able to obtain two rooms in the Education Building in addition to six rooms in the Transportation Building, one room on the second floor of the Ceramics Building, and two rooms in Engineering Hall. In 1922-23, the Department had, besides the six drawing rooms and eight offices on the top floor of the Transportation Building, one drafting room on each of the first and second floors of that building, one in Ceramics Building, and one or two in Engineering Hall. It has continued to utilize practically this same space and location to date, and, in addition has been obliged to find other rooms from time to time for the number of sections has increased materially during the intervening years. In 1945, the room assignments alloted to the Department are sufficient to accommodate about eight hundred students.

D. ENROLLMENT IN GENERAL ENGINEERING DRAWING COURSES

Yearly Registrations.- The total registration of undergraduate students in all courses administered by the Department during the first and second semesters is given in the following table by years since 1904:

1 The Departmental Office was in Room 218 Engineering Hall.

TABLE XX. REGISTRATION IN GENERAL ENGINEERING DRAWING COURSES, 1904-44

Year	First Semester	Second Semester	Total
1904-05	331		
05-06	345		
06-07	426		
07-08	446	443	889
08-09	382	369	751
09-10			
10-11			
11-12			
12-13			
13-14	448	305	753
14-15	357	313	670
15-16			
16-17			
17-18	367	295	652
18-19	First Quarter, 1019, Second Quarter 767, and Third, 413		
19-20	875	636	1,511
20-21	727	792	1,519
21-22	705	486	1,191
22-23	626	413	1,039
23-24	597	421	1,018
24-25	700	485	1,185
25-26	736	470	1,206
26-27	779	513	1,292
27-28	693	474	1,167
28-29	662	459	1,121
29-30	723	492	1,215
30-31	732	555	1,287
31-32	584	469	1,053
32-33	413	334	747
33-34	428	349	777
34-35	526	394	920
35-36	622	472	1,094
36-37	762	561	1,323
37-38	964	744	1,708
38-39	871	566	1,437
39-40	824	612	1,436
40-41	901	635	1,536
41-42	889	667	1,556
42-43	991	571	1,562
43-44	319	203	522

The registration figures in general engineering drawing courses before 1904-05 are not available at this time. During 1918-19 the enrollment reached a new high, being somewhere near 1,500 based on a semester count. The total then gradually declined to 747 in 1932-33,- the worst depression years. The number gradually increased to reach an all-time high of 1708 in 1937-38. During 1943-44, the Department gave instruction in drawing to many trainees registered in ASTP and Navy curricula in addition to the usual contingent from other colleges on the

campus. The total number of service men thus instructed for the three semesters was 369, 592, and 226 respectively.

E. DRAWING-ROOM FACILITIES

General.- Rather early in the history of the College, those in responsible charge of the work in General Engineering Drawing began to accumulate samples of drawings, models, and other materials that would serve to advantage in facilitating and illustrating drawing-room practice. In 1911, there was provided a Kelsey printing press for use in instructional work, although there had been some printing-press equipment available for student use before that time. This Kelsey outfit was turned in in 1914 as part payment for a standard Colts Armory printing press with type and accessories, which the Department still maintains. All specifications and instuction sheets for student work are printed by means of this equipment. The press room houses several thousand zinc etchings on permanent mountings for problem use in courses in drawing and descriptive geometry.

A blueprinting machine was installed in 1911 to enable students to acquire some experience in this method of reproducing drawings. Later, the Department procured a large-size electric-driven continuous blueprinting machine with electric dryer, an electric-arc machine, and Directo and Ozalid developing machines for the same purpose along with the usual baths and chemicals employed for developing prints. As soon as the north end of the Transportation Building was completed in 1921-22, the Department moved the blueprinting equipment into a large room on the fourth floor of this extension.

In 1919-20, the Department was able to provide a No. 1 photostat machine made by the Commercial Camerograph Company of New York, for the use of students in the reproduction of printed materials. The Department also owns a complete collection of modern drafting instruments for both display and classroom use, as well as a suspended pantograph and a universal drafting machine. It also has a generous collection of up-to-date machanical and structural models for drawing-room use. These include jigs and fixtures, gages, and other mechanical devices, and structural parts. There are, in addition, a number of geometric models used to facilitate

explanation of the principles of descriptive geometry as applied to the development and projection of plane sections.

F. FACULTY PERSONNEL

General.- Brief biographical sketches of faculty members above the grade of assistant that have been connected with the Department of General Engineering Drawing are listed in the following pages in chronological order according to rank.

a. HEADS OF THE DEPARTMENT

General.- The following persons have served in responsible charge of General Engineering Drawing: James D. Phillips from 1893 to 1902; Victor Tyson Wilson from 1904 to 1907; Carlos Lenox McMaster from 1907 to 1908; Fred Duane Crawshaw during 1908-10; Harry W. Miller from 1910 to 1917; and Harvey Herbert Jordan from 1917 to date. A short biographical sketch of each follows.

James David Phillips, Arch. '93, the first instructor to make the teaching of engineering drawing his chief or sole work and to continue in it for any considerable period of time, was in responsible charge from September, 1893, to June, 1902, havin had the title of Assistant Professor of General Engineering Drawing during the last five years. He developed a systematic course of instruction, prepared a mimeographed textbook, and materially improved the quantity and quality of the work. Further, in his personal and general relations with his students he was helpful and beneficial. He made such a reputation that the University of Wisconsin outbid his alma mater and took him away. At the University of Wisconsin he became successively Assistant Professor and Professor of Drawing, Assistant Dean of the College of Engineering and Mechanics, and Business Manager of the University.

Victor Tyson Wilson was graduated from the Pennsylvania Museum and School of Industrial Art, Philadelphia, in 1886. He was granted the M.E. degree at Cornell University in 1902 and served as Instructor in Mechanical Drawing there for about ten years. He was Instructor in Mechanical Engineering at Drexel Institute during 1903-04. He came to the University of Illinois in 1904 and served as Assistant Professor in charge of the Department of General Engineering Drawing from 1904 until 1907, when he resigned to accept a position as Professor of Engineering Drawing at Pennsylvania State College.

Carlos Lenox McMaster received the C.E. degree at Ohio State University in 1905. From 1905 to 1907 he was Instructor in General Engineering Drawing at the University of Illinois and from 1907 to 1910 was Associate in General Engineering Drawing, here being in charge during 1907-08. In addition, he served as Assistant Dean of Men here during 1908-10. He resigned in February, 1910, to engage in engineering practic

Fred Duane Crawshaw.- A biographical sketch of Professor Crawshaw is given under the title of Assistant Deans, Administration.

Harry W. Miller, Washington and Lee, '07, became Instructor in General Engineering Drawing in 1909, and was in charge of the work from 1910 until 1917. His administration was noteworthy for its efficiency, and his interest in the students and his helpfulness to them in general matters were everywhere recognized. In 1912, in cooperation with the members of his staff, he published for the use of his students a most excellent textbook on "Mechanical Drafting", and another on "Descriptive Geometry;" and in addition, published each year "specifications" for the series of problems to be solved by the students during that particular time. In addition to the preceding position, he was Assistant Dean of the College from 1912 to 1917 as mentioned elsewhere; and from May to August, 1917, was also Technical Director of the School of Military Aeronautics, as described later. In August, 1917, he resigned all three positions to enter military service. He made a high record in the Ordnance Division of the War Department during the World War I. The French Legion of Honor was confered upon him for conspicious services as Commander-in-chief of all railway artillery in France of the American Expeditionary Forces, in which position he spent one and a half years. After the armistice, he was assigned to make a complete investigation of the heavy artillery used by both the enemy and the allies; and presented an epoch-making report thereon, which he later put into textbook form for use in the U.S. Army Schools. However, he resigned from the Army, where he attained the rank of Lieutenant Colonel, and in the autumn of 1921 became Professor of Mechanism and Engineering Drawing in the University of Michigan.

Harvey Herbert Jordan was born in Waltham, Maine, on March 7, 1885, and received the B.S. degree in Civil Engineering at the University of Maine in 1910. He was

an Assistant in Civil Engineering at the University of Maine during 1910-11, then came to the University of Illinois in 1911 and served as Instructor and later as Associate in General Engineering Drawing. In 1917 he became Assistant Professor in charge of this work, which until that time had been under the nominal direction of the dean of the College. He continued in that capacity until 1921 when General Engineering Drawing was made a separate department and he was appointed head with the rank of Professor.

Professor Jordan has made the instructional work in engineering drawing an important and integral part of the engineering courses in a way that has influenced the attitude and interest of the students. He has the ability to develop comparatively young men into excellent and enthusiastic teachers of drawing and descriptive geometry. He is author of a book entitled "Engineering; a Career, a Culture", and is co-author with Randolph P. Hoelscher of a textbook entitled "Engineering Drawing", and with Professor F. M. Porter of another one entitled "Descriptive Geometry". He is co-author of one bulletin published by the Engineering Experiment Station. Professor Jordan served as Vice-President of the Society for the Promotion of Engineering Education during 1931-32.

In addition to his teaching duties, Professor Jordan was Assistant Dean of the College of Engineering from 1917 to 1934. Since that time he has been Associate Dean, as previously mentioned.

b. OTHER PROFESSORS

Randolph Philip Hoelscher, (B.S., 1912, and C.E., 1929, Purdue University; M.S., 1927, University of Illinois), was engaged in engineering practice from 1912 to 1916, and served as Instructor at Baldwin-Wallace College during 1916-18. He came to the University in 1918 and became successively Instructor, Associate, Assistant Professor, and Associate Professor in General Engineering Drawing during 1918-1931. In 1931 he was appointed Professor of General Engineering Drawing.

Professor Hoelscher is author of a textbook entitled "Teaching Mechanical Drawing", and is co-author with A.B. Mays of one, "Basic Units in Mechanical Drawing, Books I and II", with H. H. Jordan of one, "Engineering Drawing", with Clifford H. Springer of one, "Essentials of Drafting", and with Clifford H. Springer

and Richard F. Pohle of another, "Industrial Production Illustration for Students, Draftsmen, and Illustrators". Professor Hoelscher served as President of the Illinois-Indiana Section of the Society for the promotion of Engineering Education for the academic year 1936-37.

Clifford Harry Springer, (B.S., 1916, and C.E., 1929, Ohio State University; M.S., 1929, University of Illinois), joined the staff of the University of Illinois in September, 1924, as Instructor in General Engineering Drawing, after several years' experience in engineering practice. He was made Associate in 1928, Assistant Professor in 1931, Associate Professor in 1937, and Professor in 1943. Professor Springer has done much of the work in preparing the programs and in registering students enrolled in the Department of General Engineering and has accompanied the seniors on their annual inspection trips. He is co-author with Randolph P. Hoelscher of a textbook entitled "Essentials of Drafting" and is joint author with Professor Hoelscher and Richard F. Pohle of another, entitled "Industrial Production Illustration for Students, Draftsman, and Illustrators."

c. Associate Professors

Francis Marion Porter, (B.S., 1907, Ohio State University; M.S., 1911, University of Illinois), served as Assistant in General Engineering Drawing at the University of Illinois during 1907-08, Instructor during 1908-13, Associate during 1913-21, and Assistant Professor during 1921-41. Since 1941, he has had the title of Associate Professor of General Engineering Drawing. He is author of a textbook entitled "Mechanical Drafting", and is co-author with H. H. Jordan of another entitled "Descriptive Geometry" and with James T. Lendrum of still another entitled "Architectural Projections".

Albert Jorgensen, (B.S., 1924, Michigan College of Mines; M.S., 1928, University of Illinois), became Instructor in General Engineering Drawing at the University of Illinois in September, 1924, Associate in 1931, Assistant Professor in 1938, and Associate Professorin 1945.

Stanley Gilbert Hall, (B.S., 1923, University of Maine; M.S., 1930, University of Illinois), came to the University of Illinois in September, 1925, as Instructor in General Engineering Drawing. He was made Associate in 1931, Assistant Professor in 1939, and Associate Professor in 1945. Professor Hall is author of one bulletin published by the Engineering Experiment Station.

James Thoburn Lendrum, (B.S. in Arch., 1930, University of Michigan), joined the staff at the University of Illinois in September, 1930, as Assistant in General Engineering Drawing. He became Instructor in 1931, Associate in 1937, Assistant Professor in 1944, and Associate Professor in 1945. He is co-author with Francis M. Porter of a textbook entitled "Architectural Projections". On September 1, 1945, he was given a leave of absence to work with The Small Homes Council.

d. Assistant Professors

Robert Kent Steward, (B.S., 1908, and C.E., 1911, University of Maine), served as Instructor in General Engineering Drawing at the University of Illinois during 1909-13, as Associate during 1913-15, and Assistant Professor during 1915-16.

John Knox McNeely, (B.S., 1908, University of California; A.M., 1917, University of Southern California; and E.E., 1923, University of Illinois) was engaged as an engineer in practice and as a teacher in junior-college work after graduation until he came to the University in September, 1920, as Associate in General Engineering Drawing. He was made Assistant Professor in 1921, but resigned in the summer of 1923 to accept a position in the Department of Electrical Engineering at Washington University, St. Louis.

Rudolph Michel, (B.S., in M.E., 1916, University of Wisconsin; M.S., 1928, University of Illinois), joined the staff of the University of Illinois in September, 1923, as Assistant Professor of General Engineering Drawing. He resigned in September, 1929.

Russell Alger Hall, (B.C.E., 1916, University of Michigan; M.S., 1924, and C.E., 1932, University of Illinois), was engaged in engineering practice after graduation until September, 1920, when he became Instructor in General Engineering Drawing at the University of Illinois. He became Assistant Professor in 1928, but resigned in September, 1930, to accept an appointment with the Department of Civil Engineering at Union College.

Leonard Dilworth Walker, (B.S., 1925, South Dakota School of Mines; M.S., 1932, University of Illinois), came to the University in September, 1926, as Assistant in General Engineering Drawing. He became Instructor in 1928, Associate in 1935, and Assistant Professor in 1941.

Stanley Holt Pierce, (B.S., 1932, and M.S., 1939, University of Illinois), was engaged in engineering practice until he joined the staff at the University of Illinois in September, 1936, as Instructor in General Engineering Drawing. He was made Associate in 1940 and Assistant Professor in 1945. He was on leave of absence from November 1, 1944, until February 1, 1946, with the U.S. Navy.

e. Associates

Ralph Stuart Crossman, (C.E., 1911, Cornell University; M.S., 1925, University of Illinois), came to the University of Illinois in September, 1921. He was made Associate in 1922, and has remained with the University to date.

Paul Ellsworth Nielsen, (B.S., in C.E., 1927, and M.S., 1932, University of Illinois), became Assistant in General Engineering Drawing in Septeber, 1927, Instructor in 1929, and Associate in 1934. He resigned in September, 1936.

f. Instructors

Charles Hildebrand, (Ph.B., 1875, and M.E., 1877, Yale University), served as Instructor in Right-line Drawing during the year 1879-80.

Lincoln Bush, (B.S. in C.E., 1888, University of Illinois), served as Instructor on Descriptive Geometry here for one term in 1890. He then went into bridge work in railway and private practice, after which he joined the Delaware, Lackawanna and Western Railway serving during a period of radical reconstruction, as Bridge Engineer, Principal Assistant Engineer and Bridge Engineer, and Chief Engineer, successively from 1899 to 1909. After that he was engaged as Consulting Engineer and as Contractor on several important construction enterprises including the famous Tunkhannock Viaduct on the Delaware, Lachawana, & Western Railway. He is the inventor of the Bush Train Shed, Bush Type of Track Construction, of methods of use of sand jacks in lowering great weights, such as long-span bridges, and a new method of constructing concrete footings. He died on December 10, 1940.

John Henderson Powell, (B.S. in C.E., 1891, University of Illinois), served as Instructor in General Engineering Drawing here during 1891-92. He resigned to enter commercial work and later became interested in the real-estate business.

James Franklin Kable, (B.S., 1899, University of Illinois), served as Assistant in General Engineering at the University during 1899-01. He then was Instructor in Descriptive Geometry at the University of Wisconsin for the school year 1901-02, after which he returned to the University of Illinois to become Instructor in General Engineering Drawing. He remained here until 1904, when he resigned to engage in architectural and engineering practice.

Robert Cleyton Matthews, (B.S., 1902, University of Illinois), became Assistant in General Engineering Drawing immediately after graduation, then was Instructor in that department during 1903-05. He was transferred to the Department of Mechanical Engineering in 1905, but resigned at the end of the school year. After spending several years in practice, Mr. Matthews became Assistant Professor of Drawing and Machine Design at the University of Tennessee. He has served as National Secretary of Tau Beta Pi since 1905.

Hammond William Whitsitt, (B.S., 1903, University of Illinois), served as Instructor in General Engineering Drawing from 1903 to 1905. He resigned to engage in the practice of Architecture.

Tansey (Thomas) Radford Agg, (B.S., 1905, Iowa State College), served as Instructor in General Engineering Drawing at the University of Illinois during 1905-06 and Instructor in Theoretical and Applied Mechanics here during 1906-09. He resigned to engage in engineering practice. Several years later, he joined the staff at Iowa State College and in 1932 became Dean of Engineering there.

Robert Burns Otis, (B.S., in M.E. 1903, University of Michigan), was employed in engineering and commercial work after graduation until 1905, when he joined the staff at the University of Illinois as Instructor in General Engineering Drawing. He remained here until 1907, when he left to become Directing Engineer of the Board of Industrial Education in Milwaukee, Wisconsin.

Charles Willard Black, (M.E., 1905, Cornell University), was employed in engineering practice for a time, then served as Instructor in General Engineering Drawing at the University here during 1906-07.

Austin G. Johnson, (B.S. in M.E., 1905, University of Minnesota), served as Instructor in General Engineering Drawing here during 1906-07.

Carl Rankin Dick, (B.S. in Arch. Eng., 1907, University of Illinois), served as Instructor in General Engineering Drawing here during 1907-09. He withdrew in February, 1909, to enter engineering practice at Decatur, Illinois, with the Decatur Bridge Company.

Charles Bayard Gibbons, (B.S. in M.E., 1907, University of Illinois), served as Instructor in General Engineering Drawing during the year 1907-08. He resigned to accept a position with the University of New Mexico.

Sherwood Hinds, (B.S. in M.E., 1905, Michigan Agricultural College), was Instructor in Michigan Agricultural College during 1905-06 and at the University of Kansas during 1906-07. Then he joined the faculty of the University here as Instructor in General Engineering Drawing. He resigned, however, at the end of the first school year to enter engineering practice.

Arthur Russell Lord, (B.S., 1907, and C.E., 1910, University of Maine; M.S., 1911, University of Illinois), served as Instructor in the University of Maine in 1907-08 and Instructor in General Engineering Drawing at Illinois in 1908-09. He resigned to engage in consulting practice after which he accepted a position at Lehigh University. Several years later he became Consultant in the Progress Division, Bureau of Yards and Docks, U.S. Navy, at Washington. D. C. During 1933-35 he was administrator for the Civil Works Administration and for the Work and Rehabilitation Division of the Illinois Emergency Relief Commission. Since 1935, he has served as consulting engineer and as Assistant State Administrator for the Works Progress Administration in Illinois. He is co-author of one bulletin of the Engineering Experiment Station and is author of a book entitled "Handbook of Reinforced Concrete Building Design". Mr. Lord was awarded the Leonard C. Wason medal by the American Concrete Institute in 1927.

George Earl Martin, (B.S., 1909, and C.E., 1914, Purdue University), was Instructor in General Engineering Drawing at Illinois in 1909-10. He resigned to accept a position as Professor of Civil Engineering at Colorado College. After four years

there he went to Purdue University to become Assistant Professor of Highway Engineering.

Harold Ordway Rugg, (B.S. 1908, and C.E., 1909, Dartmouth College), served as Instructor in General Engineering Drawing at the University of Illinois from September, 1911, to February, 1915.

Rufus Crane, (A.B., 1909, Middlebury College; B. S. , 1911, Massachusetts Institute of Technology), was employed by the Boston Elevated Railway during 1911-12. He was Instructor in Baker University during 1912-13 and Instructor in General Engineering Drawing at the University of Illinois from 1913 to 1918. He resigned in April, 1918, to accept an appointment with the Forest Products Laboratory at Madison, Wisconsin.

Robin Beach, (B.S., 1913, M.S., 1922, and E.E., 1922, University of New Hampshire), served as Instructor in General Engineering Drawing at the University of Illinois from November, 1913, to the end of the school year. He resigned to accept a position at Texas Agricultural and Mechanical College.

Albert Frank Westlund, (B.S. in M.E., 1911, University of Illinois), was Instructor in General Engineering Drawing at the University from February to June, 1915.

Clarence Allen Atwell, (B.S., 1914, and E.E., 1930, University of Nebraska), served as Assistant in General Engineering Drawing at the University of Illinois during 1914-15 and as Instructor during 1915-17. He resigned in August, 1917, to engage in engineering practice.

Leo Starr Baldwin, (A.B., 1916, and B.S., 1916, University of Illinois), became Instructor in General Engineering Drawing here in 1916. He resigned in July, 1918, to become Instructor in the U.S. School of Military Aeronautics at Illinois. He was transferred to the Department of General Engineering Drawing in February, 1919, but resigned in July, following.

Morton Ford Banks, (B.S., 1915, University of Maine), served as Assistant in General Engineering Drawing at the University of Illinois during 1915-17 and as Instructor from September, 1917, to December, 1917, when he withdrew to enter military service.

William Joseph Bingen, (B.S., 1912, and C.E., 1913, University of Minnesota), served as draftsman and teacher at his alma mater during 1913-17. He joined the staff at the University of Illinois in October, 1917, as Instructor in General Engineering Drawing. He remained here until March, 1920, when he withdrew to accept an appointment in the Catholic University at Washington, D.C.

Charles Lyman Ellis, (A.B., 1910, University of Illinois), was engaged as teacher in secondary-school work from 1910 until 1917, when he joined the staff at the University of Illinois as Assistant in General Engineering Drawing. He became Instructor in January, 1918, but resigned at the end of that school year. He was made Instructor again 1919, but withdrew at the end of that college year.

James Earl Robertson, (B.S., 1909, Michigan Agricultural College), served as Instructor in General Engineering Drawing at the University here during 1918-20.

Walter Elwood Farnham, (B.S. in M.E., 1917, University of Maine), joined the staff at the University of Illinois in September, 1918, as Instructor in General Engineering Drawing, but resigned in July, 1919.

Russell A. Watt, (B.S. in Arch. Eng., 1918, University of Illinois), was made Instructor in General Engineering Drawing in October, 1918. He resigned in February, 1925, and died at Okmulgee, Oklahoma, on June 6, 1927.

Ernest Langford, (B.S., 1913, Texas Agricultural and Mechanical College M.S. in A.E., 1924, University of Illinois), was made Instructor in General Engineering Drawing at the University of Illinois in September, 1919, but was transferred to the Department of Architecture in 1920. (See Architecture).

Bernard Smith, (B.S., in E.E., 1914, Georgia Institute of Technology; M.E., 1915 Cornell University), served as Instructor in General Engineering Drawing at the University of Illinois during the school year 1919-20.

Leonard Miscall, (C.E., 1919, Cornell University), served as Instructor in General Engineering Drawing here from February, 1920, to June, 1921.

Charles Sidney Washburn, (B.S., in E.E., 1915, University of Illinois), served as Instructor in General Engineering Drawing from 1920 to 1923.

Elmer Franklin Heater, (B.S., 1911, University of Illinois), served as Instructor

in General Engineering Drawing during 1920-21, after which he became draftsman with the Engineering Experiment Station. (which See.)

Arthur Mitchell Duff, (B.S., in C.E., 1911, University of Colorado), came to the University of Illinois in February, 1921, as Instructor in General Engineering Drawing. He resigned during the summer of 1923.

Frank Whitcher Martin, (see Mechanical Engineering), was Instructor in General Engineering Drawing here from February to September, 1921, after which he was transferred to the Department of Mechanical Engineering.

Daniel Robert Francis, (B.A., 1909, and E.E., 1909, University of North Dakota), served as Instructor in General Engineering Drawing from February to June, 1921.

Allen I.Dunn, (B.E., in M.E., 1920, University of Iowa), served as Instructor in General Engineering Drawing here during 1921-22.

William James Farrisee, (S.B., 1921, Massachusetts Institute of Technology), was Instructor in General Engineering Drawing here during 1921-22.

Adelbert Diefendorf, (C.E., 1911, Ohio Northern University), became Instructor in General Engineering Drawing in September, 1921. He resigned in June, 1923.

Henry Tregellas Bowman, (M.E., 1922, Lehigh University), served as Instructor in General Engineering Drawing here from September, 1922, to June, 1924.

Arthur Alinder Lundgren, B.S., 1920, University of Illinois), served as Instructor in General Engineering Drawing during 1922-24.

George Swend Madsen, (B.S. in C.E., 1922, University of Nebraska), came to the University of Illinois in September, 1923, as Instructor in General Engineering Drawing. He resigned in June, 1926.

Erwin Walter Patzing, (B.S. in E.E., 1919, Armour Institute of Technology), came to the University of Illinois in September, 1923, as Instructor in General Engineering Drawing after having had teaching experience in Georgia Institute of Technology and in army schools. He resigned at the end of the school year.

Louis Frank Rahm, (B.S., 1921, University of Michigan), joined the staff at the University of Illinois in September, 1923, as Instructor in General Engineering Drawing. He resigned in June, 1926.

Walter Gerster Eichenberger, (E.E., 1924, Rensselaer Polytechnic Institute) came to the University in September, 1924, as Instructor in General Engineering Drawing. He resigned at the end of the school year.

Edgar Charles Clark, (B.S. in C.E., 1925, University of Kansas; M.S., 1929, University of Illinois), became Assistant in General Engineering drawing here in September, 1925, and Instructor in 1926. He resigned in 1929.

William Graves Tompkins, (B.S., 1925, Virginia Polytechnic Institute) was Instructor in General Engineering Drawing during 1926-27.

Ralph Elder Lindsey, (B.S. in A.E., 1920, University of Illinois; M.S., 1925, Iowa State College), became Instructor in General Engineering Drawing in September, 1927. He resigned in 1929.

Hayse Henry Black, (B.S., 1929, University of Iowa), was Instructor in General Engineering Drawing from September 1930 to June 1933.

Lorenzo Donald Doty, (B.S., 1925, Dennison University; M.S., 1933, and C.E., 1937 University of Illinois), served as Instructor in General Engineering Drawing from 1930 to 1932.

Horatio May Fitch, (B.S., 1923, M.S., 1933, and C.E., 1934, University of Illinois), was Instructor in General Engineering Drawing from 1930 to 1933.

George R. Fink, (B.S. in Arch., 1932, University of Illinois), was engaged in engineering practice until he joined the staff of the University in September, 1935. He withdrew in September, 1941.

Robert King Vierck, (B.S., 1932, and M.S., 1933, University of Iowa), became Instructor in General Engineering Drawing in October, 1936, but resigned in May, 1939, to accept an appointment with the Federal Power Commission.

Lloyd Butler Ritchey, (B.S., 1936, Purdue University), served as Instructor in General Engineering Drawing at the University from September, 1937, to September, 1941, when he was granted a leave of absence to enter military service.

Bernt Oscal Larson, (B.S., 1938, University of Illinois), became Assistant in General Engineering Drawing in September, 1937, and Instructor in 1938. He was granted a leave of absence in February, 1942, to enter military service.

John Edwin Pearson, (B.S., 1936, Purdue University), became Instructor in General Engineering Drawing in September, 1939. He was granted a leave of absence September, 1, 1942, to join the U.S. Armed Forces.

Millard Orlando Starr, (B.S., 1935, University of Illinois), was engaged in railway engineering practice, then accepted a Strathcona Fellowship at Yale, after which he returned to railway service. He joined the staff at the University of Illinois in September, 1941, as Instructor in General Engineering Drawing.

Walter Edmund Hanson, (B.S., 1939, Kansas State College), became Instructor in General Engineering Drawing in September, 1942. He was given a leave of absence on October 16, 1943, for war service.

Robert George Zilly, (B.S., 1942, University of Illinois), joined the Department in September, 1942, as Instructor in General Engineering Drawing, but left the University in September, 1944.

CHAPTER XVIII

AERONAUTICAL ENGINEERING

A. ACTIVITIES IN AERONAUTICS BEGUN HERE BEFORE 1944

General.- The first training in aeronautical engineering at the University of Illinois was provided in September, 1916, when E. N. Fales came to the College of Engineering as Assistant Professor of Aeronautics in the Department of Mechanical Engineering and scheduled instruction in M.E. 33, Aeronautic Engineering, for the first semester of that school year. The course materials covered the "History and Development of Aeronautic Science with critical analysis of the design and construction of aircraft". As soon as the U.S. School of Military Aeronautics was established here in 1917, Professor Fales was transferred to the new organization in charge of cross-country flying and the general theory of aeronautics; and the work in M.E. 33 was discontinued.

To provide additional background regarding instruction in aeronautical engineering here, the following somewhat detailed account of the organization and operation of the School of Military Aeronautics,- a subsidiary of the U.S. War Department,- as established here in 1917 for war-training purposes and as recorded in the 1918-19 issue of the Annual Register, is included.[1]

"On February 7, 1917, the University of Illinois offered the use of its buildings and equipment to the Government for war-preparation work. Acceptance of this offer was made on February 10, 1917. The United States School of Military Aeronautics at the University of Illinois was opened on May 21,1917.

****

"On October 14, 1918, a curriculum of instruction for pilots, observers, fighting observers and bombers was inaugurated. Up to this time the curriculum provided only for instruction of pilots for the air service. On March 11, 1918, a twelve-week curriculum was put into effect. Prior to this time, the course was eight weeks long. In both the eight and twelve weeks' courses of instruction those subjects which were considered fundamental to the training of an aviator were given. The subjects were arranged by departments, of which there were seven......... The departments of Observation and Aerial Tactics were combined in the curriculum furnished by the Schools Branch Office of the Air Service, Washington, D. C.; officially, therefore, there were seven departments including the department of Military Tactics. One squadron, or class, entered each week

1. Pages 419-20

and one squadron graduated each week. The average size of a squadron for the duration of the School was nearly fifty.

"While the eight-week's curriculum was in progress, the School was divided into two wings:

"A Junior Wing of three weeks' duration, in which stress was laid on instruction in military studies (i.e., army regulations, military law, military sanitation and hygiene, organization of the armies, etc.), and in machine gunnery and telegraphy, together with practical work in military drill.

"A Senior Wing, comprising the last five weeks of the course, was devoted more particularly to lectures and laboratory work on signalling, gunnery, aerial tactics, bombs and bombing, theory of flight, cross-country flying, map reading, meteorology, night flying, instruments and compasses, construction nomenclature, rigging, care and repair of airplanes, internal-combustion engines and their construction, and finally instruction in the methods of cooperation between the aircraft and the artillery and infantry.

"The total number of hours' instruction in the eight-weeks' course was 312; that is, 39 hours a week of actual instruction, inclusive of lectures, laboratory, and drill. The work was of an intensive nature, designed to give the candidate for an Aviation Pilot's License a thorough training in the various branches which are included in the daily work of an aviator. No instruction whatever was given in practical flying, that being reserved for the Aviation Schools.

"The twelve-week's curriculum was divided into wings. The type of instruction given the Junior Wing in the eight-weeks' course was preserved in the twelve-weeks' curriculum for the first few weeks of instruction. The curriculum for the middle weeks of the course was technical in character, while instruction under the curriculum for the last few weeks dealt largely with official information. It was deemed wise to eliminate cadets before they reached the third stage of instruction i if they failed to show an aptitude for the work of the course.

"The total number of hours of instruction in the twelve-weeks' course was 440, an average of 36 2/3 hours per week. Increases in the number of hours of instructi for academic subjects were made for Airplanes, Engines, and map reading in Observation, while the military was increased by 54 hours of Military Tactics and Inspection, and 21 hours for theoretical Military studies.

"Instruction in the School was given in certain rooms in several of the University buildings. The Gymnasium Annex (old Armory) was used entirely for laboratory work. To this building an annex was added, giving an additional laboratory floor area of 7,200 square feet. The School increased in size from twenty-five cadets during the first week of instruction in May, 1917, to 836 on July 22, 1918. The total number of cadets entering the School during its history of approximately nineteen months was 3,625, of which number 2,691 were graduated and 596 were discharged up to the day when instructional work stopped, November 22, 1918. At this time there were 338 cadets in the School.

"Cadets were housed in the Y.M.C.A. Building, known as Barracks No. 1. and in the Women's Residence Hall, known as Barracks No. 2. Mess was provided in each of these buildings. Cadets had access to the University libraries, and special library facilities were provided in each barracks. The Engineering College Library arranged a special department of books and periodicals on aeronautics".

The staff was composed of both Army and civilian personnel, most of the teaching staff being members of the College of Engineering faculty.

Professor Fales was transferred to an Army assignment at Dayton, Ohio, in August, 1918, and no further instruction was given here after the closing of the School of Military Aeronautics until the beginning of the academic year 1920-21, when Matthew R. Riddell, who had joined the College staff as Assistant Professor of Aeronautic Engineering in the Department of Mechanical Engineering in February, 1920, scheduled two courses M.E. 33, Aeronautic Engineering, with the same description as originally announced in 1917, and M.E. 34 a continuation of M.E. 33.,-M.E. 33 coming the first semester with prerequisite of senior standing in the College of Engineering and, in turn, serving as prerequisite for M.E. 34 coming the second semester.

Some additional training in aeronautics was provided here when the Civilian Pilot Training School Program was established in 1939, as described in the following section.

<u>Civilian Pilot Training School.-</u> Pursuant to the Civilian Pilot Training Act of Congress of 1939, which authorized the Civil Aeronautics Authority to provide a program for the training of civilian pilots through educational institutions, the ground school work for civilian pilot training for students was begun in two sections by the College of Engineering as an extracurricular program without University credit, on November 13 and 14, 1939. The sections met twice a week during the twelve remaining weeks of the semester and continued into the second term until the students had acquired the 72 hours of instruction covering the following topics:

History of Aviation	2 Hours
Civil Air Regulation	12
Navigation	15
Meteorology	15
Parachutes	1
Aircraft and Theory of Flight	15
Engines	5
Instruments	5
Radio Uses and Forms	2
	72

The actual flight training was begun about December 1, 1939. The Civil Aeronautics Authority had approved the Champaign airport, which was located about two miles northwest of Champaign, as an official flying field. It was equipped with five planes for instructional purposes of an approved type and an equal number of certified instructors. From 35 to 50 hours of flying instructions were given three hours a week in one-hour periods over both semesters.

During 1939-40, fifty applicants, the University quota, were trained, and of this total, forty men and one woman received pilot certificates. The work was offered again during the summer of 1940. The work in 1940-41 was given in two courses each semester, a preliminary course entitled "Controlled Private Flying Course" and a secondary course entitled "Controlled Restricted Commercial Course", the completion of the two courses being deemed the equivalent of the Army Primary Course. The University quota for the first course was fifty and for the second, ten, for the first semester of 1940-41.

In July, 1942, the College undertook an accelerated program of training under the Civil Aeronautics Administration. This program, later designated as the C.A.A. War Training Service, consisted of eight-week sessions in which each enrollee received 240 hours of ground schooling and from 35 to 40 hours for flight instruction. After January, 1943, the classes were composed of Air Corps Cadets in the Navy V-5 Program. A new group of 20 students was enrolled for each session. The program of study included courses in mathematics and physics, military and physical training, meteorology and navigation, aircraft identification, civil air regulations, and general servicing and operation of aircraft. Faculty members of several departments of the University cooperated in teaching these courses, under the direction of the Dean of the College of Engineering. This work was later transfered to the Navy-12 program.

Aeronautical Option in Civil Engineering.- Further instruction was offered in aeronautical engineering when the Department of Civil Engineering in September, 1942, as mentioned in Chapter XXII, set up an option in Aeronautical Engineering to run parallel with a number of other options scheduled for the work of the

senior year. The special courses relating to this particular field that were included in this option were C.E. 10, Navigation; M.E. 33, previously mentioned; C.E. 24, Airport Design; and C.E. 70, Airplane Stresses. These courses were intended to provide the students with a working knowledge of airplane design and construction, with the development of airport facilities, and with the fundamental principles of aircraft navigation. The option has continued to the present time with one or two modifications in course numbers.

Aircraft Structures Testing.- The first attempts here at research work in connection with aircraft structures was begun in the Talbot Laboratory about 1940. This work is still being carried on in the conduct of tests of propellers, wing ribs, and other structural parts of planes to supplement the study of design and strength of both trussed and stressed-skin types of aircraft structures. Materials testing machines with the usual run of strain gages and other auxilliary appliances are available for the examination of standard sections, and drop-test machines are at hand for the study of the behavior of landing gear under impact. Photoelastic apparatus has been assembled and has been in use for some time for the determination of the stresses around holes and angles and in irregular and complicated section of the structure.

B. ORGANIZATION OF THE DEPARTMENT OF AERONAUTICAL ENGINEERING

General.- In the summer of 1944, the Board of Trustees of the University authorized the establishment here of a separate Department of Aeronautical Engineering in the College of Engineering, with Professor Henry S. Stillwell, who was then in charge of a similar department in the University of Kansas, as Head with the title of Associate Professor of Aeronautical Engineering. Professor Stillwell arrived on the campus in October following, and at once began to arrange to have the first five semesters of instructional work of his department begin at the opening of the fall semester, November 2.

Aeronautics Advisory Board.- In the early part of 1944, the Board of Trustees of the University authorized the appointment of a University Aeronautics

Advisory Board that could act in an advisory capacity in the organization of a new Department of Aeronautical Engineering here and in the formation of an instructional and experimental program. Dr. Baldwin M. Woods, Professor of Mechanical Engineering and Director of University Extension, University of California at Berkley, became Chairman of this new Board. The other seven members were actively engaged in work representing some phase of the aircraft industry, and brought to the Board a balance and breadth of experience that were valuable in determining the course of the University's contribution to aviation development.

C. OBJECTIVES

General.- It is important to observe at the outset that the instructional program provided here by the Department of Aeronautical Engineering is designed to train students on the same high college level of scope and performance as those that have been long in effect in other departments of the College of Engineering in preparation for professional service,-that it is not a mere pilot-training course of study, however important a place such training fills in the aviation industry, although pilot training has been a natural by-product of such provision. It is intended to afford instruction to engineering students who are interested in preparing themselves for positions that involve the design, construction, production, and operation and maintenance of aircraft and aircraft appliances. In addition, the plant arrangement affords splendid opportunity for faculty and experimental staff, graduate students and even undergraduates to engage in scientific research projects that are vital to the development of principles and their application to the technical problems relating to air transportation.

D. OFFICE, CLASSROOM, AND LABORATORY ACCOMMODATIONS

General.- In the fall of 1944, the suite of rooms at 101 Transportation Building formerly occupied by the Department of Railway Engineering, was assigned as the office of the Department of Aeronautical Engineering. Classes were held in the Transportation Building along with those from other departments. The

building formerly used as a locomotive laboratory was remodelled to some extent for an aeronautical laboratory, and two new offices were provided there on the second floor in the space formerly used as a fan and storage room. The facilities of the new Airport became available for the use of the Department when they were opened for service in October, 1945.

E. THE DEVELOPMENT OF LABORATORY FACILITIES

General.- It will require a great deal of time and effort to provide ample laboratory facilities for this new department. Equipment for a number of laboratories, however, is being assembled and arranged for both instructional and experimental purposes. For the present, one of these is housed in the Aeronautical Engineering Laboratory Building formerly used for the locomotive testing plant, and the others at the new Airport.

Aerodynamics Laboratory.[1] The aerodynamics laboratory, located in the Aeronautical Engineering Laboratory Building, provides for a closed-throat, return type of wind tunnel with an overall length of 27 feet and an overall height of 15 feet. The tunnel has an octagonal test or throat section that measures 30 inches by 48 inches in size,- the contraction ratio being four to one. It has a horizontal jet and is powered by a 50-horsepower electric motor with a variable-voltage control that drives a directly-connected, three-blade propeller which is 4 feet 1 ½ inches in diameter to provide a wind velocity at the test section of about 130 m.p.h. The tunnel has a six-component balance which measures lift, drag, side force, roll, yaw, and pitch. This balance, mounted in the throat section where both model and instruments may be observed simultaneously, permits observations on variations of both the angle of attack and the angle of yaw.

The Aircraft Power Plants Laboratory.[1]- The aircraft power plants laboratory is located at the University Airport. The facilities provided here are used to make tests of engines, engine installations, jet propulsion units, and burner appliances.

1. The Technograph, December, 1945, Pages 9 and 10.

An air jet for operation at speeds slightly below that of sound is provided for the study of burner and airfoil equipment. This arrangement allows opportunities for instruction and research in aerodynamic phenomena in the trans-sonic range, a field little known at the present time.

The Aircraft Laboratory.[1]- The aircraft laboratory, also located at the Airport provides facilities for making static and dynamic tests of component parts of airplanes, of assemblies, and even of complete airplanes. The use of this plant affords opportunities for the verification of structural theories relating to the design of new types of equipment or the improvements of those already in operation.

F. PERSONNEL

a. HEAD OF THE DEPARTMENT

Henry Sheldon Stillwell was born in Kansas City, Missouri, on May 15, 1917. He received the B.S. degree in Aeronautical Engineering at the University of Minnesota in 1939 and the M.S. Degree there in 1940. From 1940 to 1942, he was Instructor in Aeronautical Engineering at his alma mater. He then served as Head of the Department of Aeronautical Engineering at the University of Kansas until October, 1944, when he came to the University here as Associate Professor in charge of the newly-created Department of Aeronautical Engineering.

Professor Stillwell, experienced in flying since 1935 and a licensed pilot since 1941, has had an extensive contact in engineering and consulting practice with various aircraft designers and producers and in experimental work in connection with those engaged in aircraft operation.

b. Assistant Professor

Robert Winston McCloy, (B.S. in M.E., 1937, University of Iowa), gained experience in teaching at the University of Kansas and the Missouri School of Mines and came to the University of Illinois in July, 1945, as Assistant Professor of Aeronautical Engineering.

1. The Technograph, December, 1945, Pages 9 and 10.

A HISTORY OF THE COLLEGE OF ENGINEERING OF THE UNIVERSITY OF ILLINOIS 1868-1945

Part I

BY

IRA O. BAKER, C.E.'74
Late Professor of Civil Engineering, *Emeritus*

AND

EVERETT E. KING
Professor of Railway Civil Engineering, *Emeritus*

URBANA, ILLINOIS